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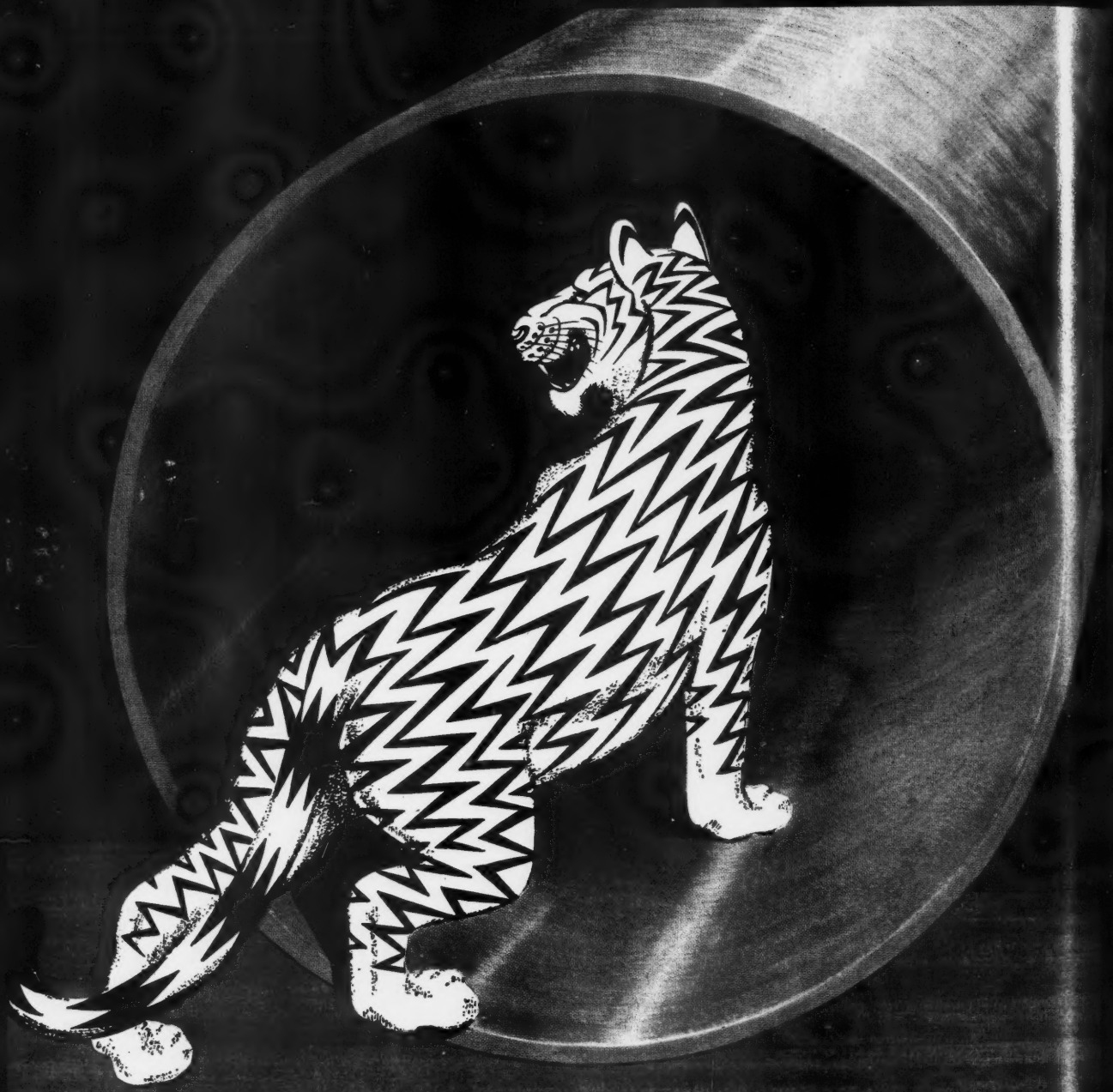

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ELECTRICAL REVIEW

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26 AUGUST 1955

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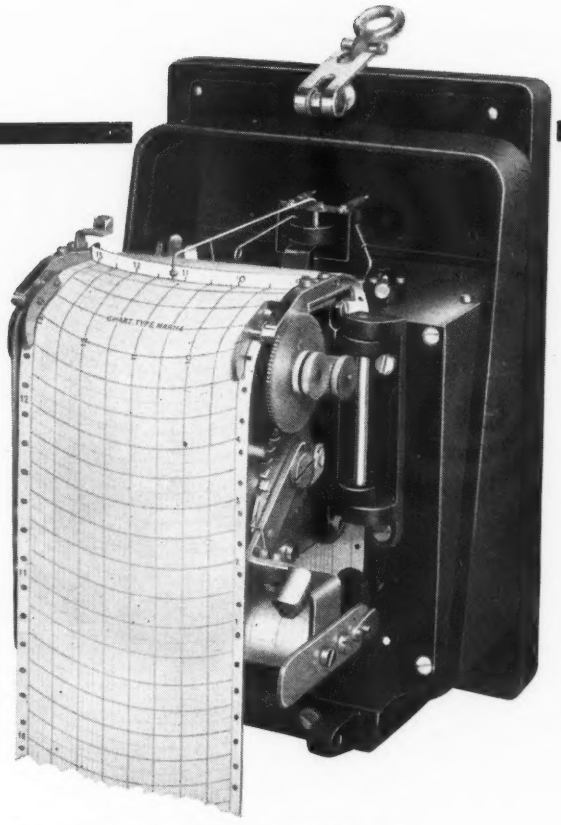

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ELECTRICAL REVIEW

26 August 1955 Vol. 157 No. 9 Established 1872

Standardization

PROVIDED that it is not done at too early a stage and is not so rigid as to retard development standardization is a measure of progress. To an exporting nation such as our own standardization is of particular importance. At the recent meeting of the International Electrotechnical Commission in London (reported in the *Electrical Review* of 29th July and 5th August) Dr. Osborne, the retiring president, referred to the rapidly increasing interest in international standardization in the electrical field and a comment on the work of Technical Committee No. 17 (switchgear) is that exports of machine tools are in many cases hindered by the adoption of different electrical clearances for the control gear in the various national prescriptions.

A sign of the good health of the Commission is the setting up of various new committees including the new technical committee on relays and the new committee on high voltage techniques which was formed to draw up recommendations covering testing techniques related to impulse voltages and currents. This also applies to the proposal to set up a new committee on electric furnaces submitted by Belgium.

There is abundant evidence of agreement among the members of the large number of technical committees but they by no means accept at once every proposal put before them and there have been cases of hard hitting bargaining. For instance, Committee No. 2 (rotating machinery) found it was not possible to reach agreement on clauses dealing with wave-form irregularities and the matter was referred back to the National Committees. Again, Committee No. 7 (aluminium) which last year reached a tentative agreement on the international standard of resistance for aluminium (1/37 ohm/mm^2/m) dropped the proposal in London this year and replaced it by a conventional value of resistivity of commercial hard drawn aluminium wire (0·028264 ohm/mm^2/m).

The diversion of the attention of Committee No. 22 (power converting equipment) from mercury arc rectifiers to semi-conductor rectifiers is one of the many examples of forward thinking, while an outstanding example of the large amount of future work facing the Commission is the study by Committee No. 17 (switchgear), including a new basis for rating power circuit-breakers. Another sign of advancement after hard work is a draft specification by Committee No. 36 (insulators) for bushing indicators.

We think that the Committee of Action is now in a very strong position with its membership representative of Belgium, Canada, France, Germany, India, Italy, the Netherlands, Norway and the United Kingdom. Finally it is very gratifying to know that so eminent an English engineer as Dr. P. Dunsheath is to be the president of the Commission for the next three years.

NUCLEAR POWER COSTS

A common feature of nuclear and water-storage power stations, which was referred to at the recent Atomic Energy Conference at Geneva, is a high ratio of capital to running charges. The allocation of duties between them will differ from one country to another. In Britain nuclear stations are to carry base loads, leaving variations in electrical demands to coal-fired installations with the aid of hydro stations of limited storage capacity and pumped storage (Kay). In Canada (Davis and Lewis) transmission costs (about 0·09d/kWh/250 miles) may make local nuclear power profitable at perhaps 0·7d/kWh; moreover in Southern Ontario imported coal seems the only alternative. Even in Norway transmission difficulties might make small reactors attractive (Dahl). Intermittently operated nuclear stations could compensate for rainfall deficiencies in French hydro areas, since, it was submitted (Ailleret and Tarander), reactor depreciation depends not on age but on the period of active use.

ENGINEERS' WAGES CLAIM

In recommending an increase in the wages of engineers and shipbuilding workers last year, the Courts of Inquiry into the demand which had been made by the trade unions said:—

> "We do not believe that the sort of increase which we think is justified in this particular claim could by itself have disastrous effects, but it is a part of a more general movement of wages, costs and prices. Such a movement if continued, and particularly if accelerated, could conceivably undermine our whole economy."

Since that was said (February, 1954) the movement referred to has continued at a faster pace and it is with this in mind that the latest demand has to be examined. The last claim was for an increase of about 16 per cent in basic rates; the Courts of Inquiry thought that 6 per cent was justified. Now the unions ask for an unspecified "substantial increase" (15 per cent is believed to be envisaged) and coupled with that demand are proposals for a reduced working week, a limitation of overtime and an extra week's holiday with pay. Export trade, which is already experiencing the effects of continued wage increases without commensurate increases in production per man-hour, is bound to be seriously affected if the demands are met. The inquiry to which we have referred was so comparatively recent that it is difficult to see what useful further steps can be taken.

STANDARDIZATION AND PRODUCTIVITY

When one finds that a plug which will go into a socket in one room fails to fit in another exasperation results, but this lack of standardization in the home, although most undesirable, is not nearly so serious as it is in industry where much more important and expensive items than plugs and sockets are involved. As a result industrial costs are far higher than they should be. With suitable standardization throughout a factory big cuts can be made in the stocks which have to be held and longer production runs are made possible, the consequent economic advantages being powerful factors in reducing prices. As industry has tended, with one or two conspicuous exceptions, to fight shy of standardization, its costs are often unnecessarily high, even with up-to-date manufacturing techniques. If the advantages of automation are to be realized, an appreciation of what standardization implies is essential for all concerned with the running of industry. Realizing all this the British Productivity Council recently published a pamphlet dealing with standardization as an aid to productivity. Quite rightly it points out that standardization does not mean drab uniformity. The ideal definition of the term might be the method of securing the maximum variety of end product with the minimum variety of components.

INCREASING PRODUCTION

Ever since the early summer of 1940 when the intense phase of wartime production started the emphasis in our industrial life has been on ever increasing production. It is evident to us as the result of a very long and almost continuous succession of visits to all manner of factories and works, from coal mines and steelworks to instrument component works, that the increasing production has been brought about all along the line as the result of further and improved electrification. And this improved electrification has been particularly marked by its close association with two special trends—automatic control and materials handling. Regarding the first of these we do not refer in particular to what is now being termed automation, although we appreciate that this is a logical step in the trend we are trying to depict. We stress instead the inherent aspect of electrical control (including electromagnetic control, thermo-electric control and electronic control) without which all forms of industrial electrical service—driving, heating, plating, welding, etc.—would not have the high value they have attained in terms of increasing production. We regard the second trend, materials handling, as essentially an electrical development, because it is obvious that without the electric drive and its associated electrical control specialized modern materials handling would and could not have come into being. The call for increasing production still goes on and we believe it will continue to be met by still further improvements in electrification with a still greater employment of electrical control and materials handling.

THE ENGINEERING, MARINE AND WELDING AND FOUNDRY TRADES EXHIBITION

This exhibition, with over five hundred exhibitors, opens on Thursday next week at Olympia and continues for a fortnight, closing on 15th September. Our issue of 2nd September will contain a comprehensive account of the equipment on show which is likely to be of interest to our readers, together with illustrations of many of the new items.

Heat-Treatment Problems

Their Solution in Electric Furnaces

By R. O'DONOGHUE

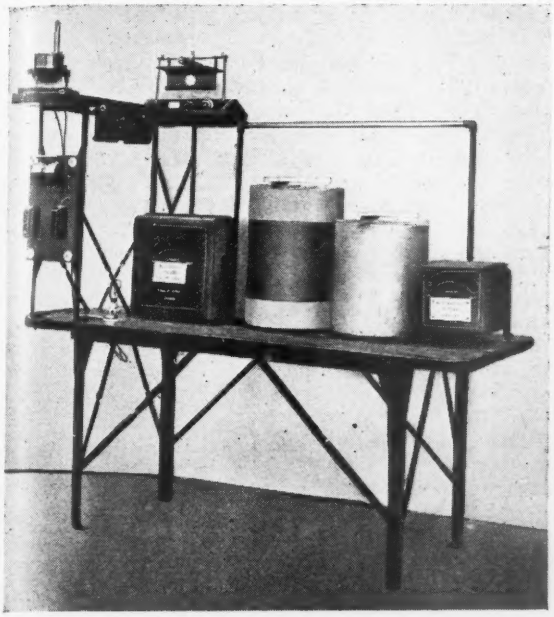


Fig. 1.—A very early Wild-Barfield automatic hardening furnace installation (Wild-Barfield Electric Furnaces, Ltd.)

FOR many years, the characteristics associated with electric resistance furnaces have played their part in solving problems of heat-treatment. Probably one of the earliest of these was the automatic hardening furnace produced during the first world war. In that particular instance, the problem concerned the correct moment to quench small parts such as carbon steel gauges. Research had established that the required structure was obtained if the steel were quenched when it had become non-magnetic. An equipment was therefore designed which indicated by a pointer on a scale when that condition was obtained. Fig. 1 illustrates such an early automatic hardening furnace layout. Since those days, improvements in heat-treatment techniques have largely rendered this particular type of equipment obsolete, but it stands as a classic example of a heat-treatment problem solved by using an electric furnace.

Silicon iron stampings for the stators and rotors of squirrel cage motors have to be annealed to obtain the required magnetic characteristics and in addition must be given an insulating coating. These two processes can be carried out simultaneously in an electric furnace, using an atmosphere of partially burnt town's gas, the necessary careful control of both the heating and cooling being obtained with automatic control gear.

A small installation capable of dealing with a charge of some 10,000 stampings consists of a 70 kW horizontal batch furnace with a controlled atmosphere plant producing up to 300 cu ft of atmosphere per hour. The treatment cycle consists of raising the furnace temperature to 700 deg C before the charge is inserted, whereupon it falls to 540 deg C due to the quenching effect of the cold metal. The temperature is then gradually raised to 600 deg C and held there for one hour, after which the stampings are allowed to cool very slowly for seven hours before being exposed to air to cool to room temperature. One of the results of this heat-treatment is that the stampings acquire a coating of oxide which serves as an electrical insulator. The furnace used for these operations is shown in Fig. 2.

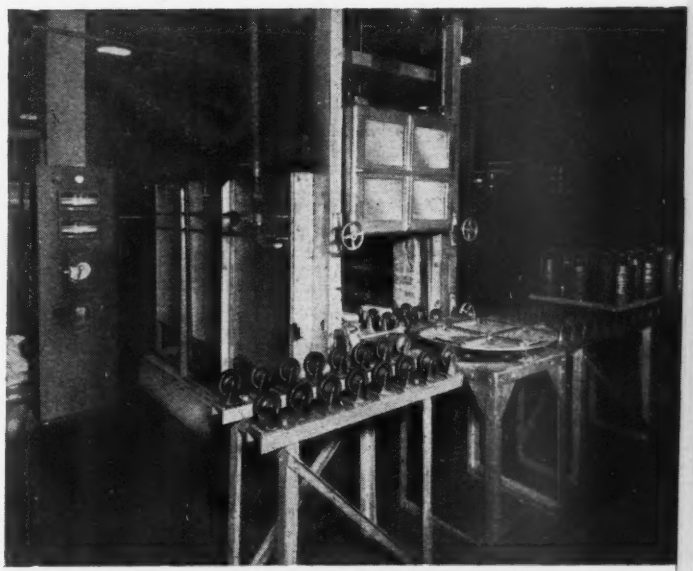


Fig. 2.—A 70 kW horizontal batch furnace installation for annealing and, at the same time, forming an oxide coating on silicon iron stampings. (General Electric Co., Ltd.)

The introduction of carbon into the surface of steel has been carried out in a number of ways, but the precise control of such an operation on a commercial scale and at nearly the maximum theoretical rate is best achieved by the gas

Fig. 3.—Wild-Barfield prepared town's gas carburizing installation. (Albion Motors, Ltd.)

Fig. 4.—Batch furnace for carbonitriding. (General Electric Co., Ltd.)

carburizing technique. This consists of introducing a suitable atmosphere into a specially constructed furnace in which a charge is placed, and keeping the charge at a predetermined temperature over a period which varies according to the case depth required. Fig. 3 illustrates a prepared town's gas carburizing installation, the gas preparation unit being shown on the left. This equipment not only carburizes at the near maximum theoretical rate, but permits precise control of the depth and type of case.

Furthermore, there is no sooting, with its " stopping off " effect and possible soft spots causing rejected work, any slight deposit from the prepared town's gas process being in the form of pulvurent graphite. As opposed to many such processes, the drip feed gas carburizing system using " Carbodrip " gives results comparable with those of the prepared town's gas method, and thus it might be said that the problem of rapid and precise drip feed gas carburizing has been met by the use of electric furnaces.

The process of carbonitriding consists of introducing carbon and nitrogen, in proper proportions, into the surface of steel. A carburizing gas to which is added ammonia, from 2½ per cent upwards, is the atmosphere normally used. As a result of the heat-treatment followed by oil quenching, mild steels are given a hard case, generally up to 0·025in thick. The treatment temperatures required are some 100 deg C lower than those used in normal gas carburizing, so that the chance of distortion of thinner sections of work is lessened, although the wear-resisting properties of the case are superior to those obtained by straight carburizing.

Equipment usually employed is either of the batch or continuous types, and where a quench or isothermal treatment is to be given to the steel after the hardening process, the bath is made an integral part of the furnace. Fig. 4 shows a horizontal batch furnace design in which the complete process, including oil quench or alternatively cooling in the carbonitriding atmosphere, can be carried out without cooling down the heating chamber or exposing the charge to air. The furnace is arranged for front operation and small parts can be processed in wire mesh trays loaded on to a grid carrier tray. The tray is moved into and out of the furnace manually from a roller top charging table. Alternative charge-carrying platforms allow cooling or quenching to be carried out whilst another charge is in the carbonitriding chamber.

Rotary hearth, pusher type or shaker hearth furnaces may be employed where continuous production is required. The first-named should have suitable gas locks to protect the furnace atmosphere, but with the pusher type and shaker hearth furnaces the atmosphere is usually burned off at the chamber entry. For this reason, vestibules are made as small as is practicable to reduce the volume of atmosphere consumed.

Fig. 5 illustrates a shaker hearth furnace for carbonitriding small components which are fed to the hearth tray by means of a hopper synchronized to operate with the tray. To ensure even progress of parts through the chamber to obtain regularity of case depth the hearth tray is ridged from side to side throughout its length, the depth and pitch of the ridges controlling the amount by which the work is shaken forward in conjunction with the strength of the tray's forward motion. The tray is moved rearwards by a cam driven by an electric motor through reduction gear and an infinitely variable speed drive: forward motion is by coil springs. Adjustment can thus be made in two different places to give great flexibility to the operation of the furnace.

The problem of annealing coils of ferrous and non-ferrous strip or wire without scaling is met by using cylindrical batch furnaces with a controlled atmosphere. Two types are commonly employed—the bell, where the furnace is moved over the charge after it has been sealed in a metal container, and the vertical cylindrical furnace where the charged container is moved into the furnace.

A bell furnace installation for annealing up to 700 tons of coiled silicon steel strip a week is shown in Fig. 6. Each furnace is required to handle charges up to 20 tons and the coils are nearly 5ft in diameter. The coils are mounted as a stack 8ft or more in height on a furnace base and are sealed under a heat-resisting steel hood. The hood itself is of lightweight construction so that the mass of metal to be heated is kept to the minimum. Steel posts adjacent to the base accurately position the furnace bell (which carries the heating elements) when it is lowered over the base.

Heat-treatment is carried out at a temperature between

740 deg C and 780 deg C in an atmosphere of cracked and burnt ammonia, the atmosphere being circulated through the charge by a fan unit in the centre of the furnace base. The atmosphere passes along a guide and between plates, which separate the coils, before returning through the centre of the coils. The function of the guide and plates is to take the swirl out of the atmosphere before it returns to the fan, as well as to ensure the most efficient circulation.

Each furnace is rated at 360 kW and has its elements arranged in two circuits, one of which is automatically switched off just before the desired working temperature is reached. This 50 per cent reduction in power input prevents the temperature overshooting the control point.

In many industries problems of heat-treatment can be solved by employing standard equipment possibly modified in some degree. Other cases require specially designed plant such as that illustrated in Fig. 7. This was for the softening of the ends of hacksaw blades, and care had to be taken that the ends only were annealed. In operation, the blades are placed on a conveyor, one side of which travels in the open-sided chamber and the blades are turned end for end to pass through a second time. There are separately controlled heating zones affording a gradual heating and cooling.

Fig. 8 illustrates another example of specially designed equipment. The installation consists of a number of tube furnaces for the hardening of needles. Previously, the needles had been hardened in a separate section in batch-type furnaces. The problem presented was to incorporate into the production line a battery of furnaces capable of hardening all sizes of needles. Each furnace consists essentially of a solid drawn heat-resisting tube, which acts as the heating element, inclined at an angle and having a concentric return tube. The space between the tubes is filled with insulating material, and cable clamps are fixed to the feeding end for connection to an air-cooled mains transformer. The outer tube is surrounded by an insulating powder in a cylindrical case fitted with a flexible plate at the feed end to allow for expansion of the tubes. At the discharge end, a chute extends below the level of the oil in a quench tank.

Needles are fed to the equipment from a hopper, and they flow through the inclined tube furnace by the energy provided by a "Syntron" vibrator mounted below the furnace casing. The rate of flow can be varied by adjust-

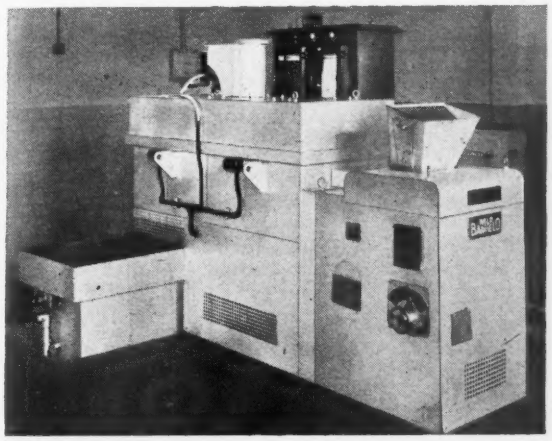


Fig. 5.—Shaker hearth furnace for carbonitriding. (Wild-Barfield Electric Furnaces, Ltd.)

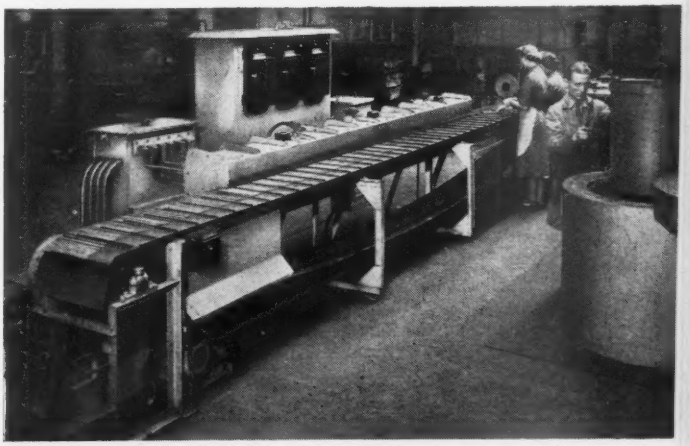


Fig. 7.—Special installation for softening the ends of hacksaw blades. (Wild-Barfield Electric Furnaces, Ltd.)

Fig. 6.—Bell furnace installation for annealing up to 700 tons of coiled silicon steel strip a week. (General Electric Co., Ltd.)

Fig. 8.—Vibrator tube furnace for needle hardening. (Needle Industries Ltd., and Wild-Barfield Electric Furnaces, Ltd.)

ing the incline of the furnace tube and by controlling the vibrator.

Temperature is controlled by a Kelvin Hughes electronic controller mounted in a separate cubicle. Each furnace is rated at 6 kW and has a maximum operating temperature of 850 deg C, with an output of approximately 15 lb of needles an hour. By reason of the automatic nature of the equipment, one operator can attend to four furnaces, as placing needles in the hoppers and removing them hardened from the quench tanks are all that is required.

The increasing use of electric resistance furnaces for heat-treatment springs from several factors, not the least of which is the precise temperature control. In addition the inherent cleanliness of electrically-heated equipments and the freedom from deleterious gases of combustion gives them an advantage over furnaces heated by other means.

It would hardly be true to say that none of the applications covered in these notes could be met with other than by electrically-heated furnaces, but in most cases, particularly where the movement of the furnace itself is involved, as in Fig. 6, the simplicity of connection and of variation of input control tends to favour electric furnaces. Furthermore, various other means of heating generally have a deleterious effect upon furnace brickwork, which leads to increased maintenance costs.

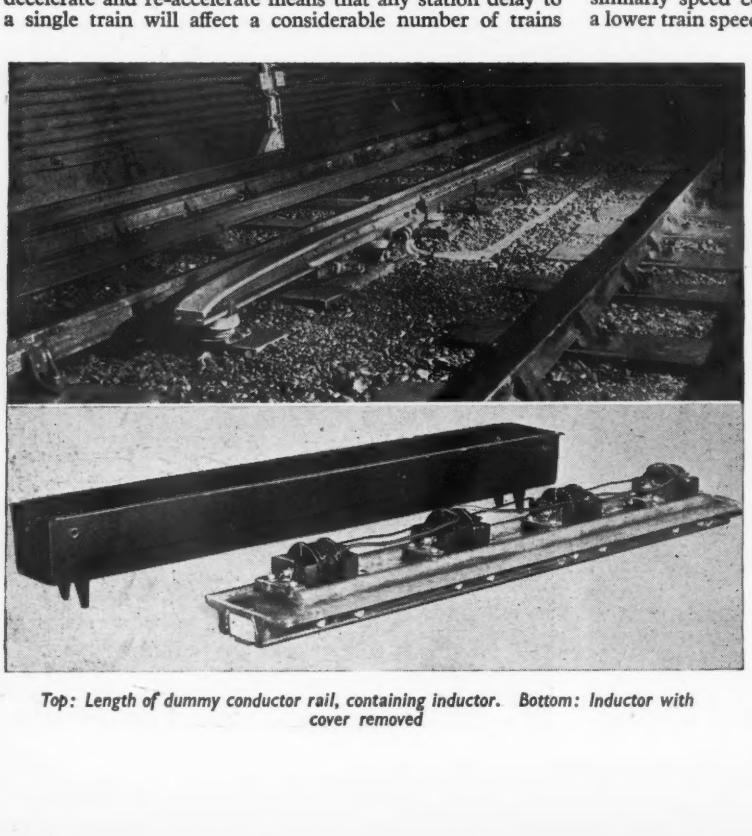
The installations dealt with are typical, and obviously do not cover the whole range of problems posed by various heat-treatment processes.

Measurement of Underground Train Speeds

A NEW type of equipment for measuring the speed of Underground trains has been designed and introduced by the Signal Department of London Transport. The equipment incorporates a method of detecting the speed instantaneously instead of over a measured stretch of line.

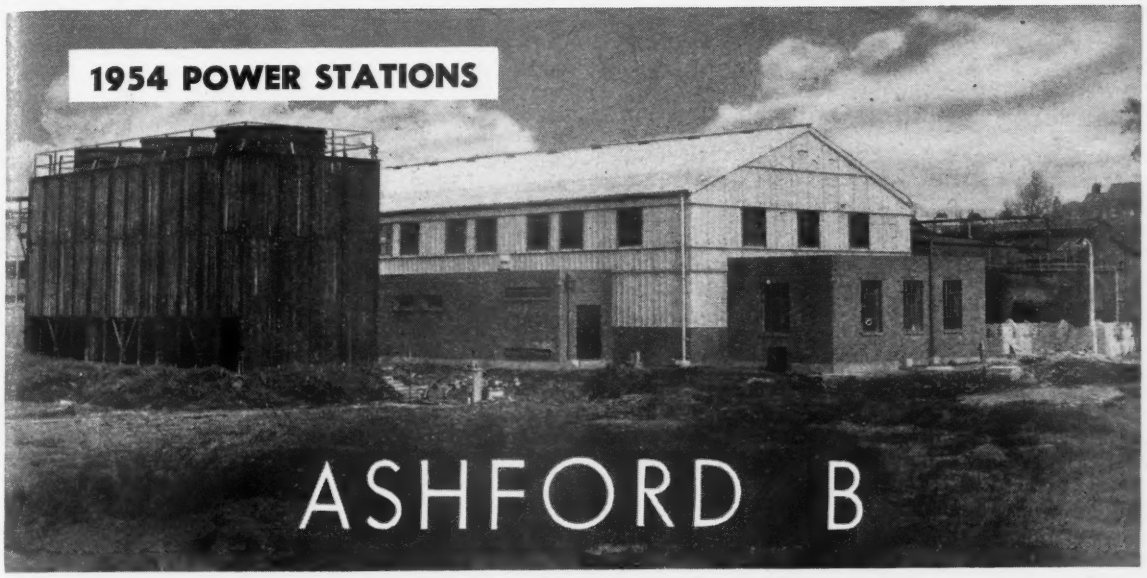
Speed control signalling has been in use on London Transport since 1948 in order to overcome the "checking back" of a series of trains which takes place when a train ahead is held in a station platform for an abnormally long period by heavy traffic. A train standing at a platform is protected by the home signal behind it, the position of the home signal being decided by the maximum distance needed to halt a following train travelling at maximum possible speed if it should pass the home signal at danger and be automatically "tripped."

When a train remains in a station platform for more than 30 sec the train behind will be halted by the home signal. This halt between stations and the consequent need to decelerate and re-accelerate means that any station delay to a single train will affect a considerable number of trains and disorganize the running of the whole service. Speed control signalling enables the home signal in such a case to clear earlier, provided that the train approaching it is travelling at the required reduced speed. Additional signals, usually either one or two, are interposed between the original home signal and the platform to protect the train standing in the platform. Hitherto the speed control of a signal has been achieved in London Transport practice by arranging to time the train over a fixed length of track, the length being such that it takes approximately 4½ sec to pass over it at 25 m.p.h. A train passing into the timing section brings into operation a time relay which is so set as to complete its operation and close an electrical contact in 4½ sec. If the speed of the train is 25 m.p.h. or less over the timed stretch the relay will have closed its contact before the train reaches the end of the section and the signal will clear as the train approaches so that it can be passed without a halt. An intermediate home signal will next be approached and this is similarly speed controlled but is arranged only to clear at a lower train speed. The above type of apparatus, however, does not enable the maximum advantage to be gained from speed control signalling because it is only possible to measure the average speed over the timed section.



Top: Length of dummy conductor rail, containing inductor. Bottom: Inductor with cover removed

A new speed detector, evolved after experiments by Mr. R. Dell, the signal engineer, has been introduced to measure the speed instantaneously. A length of what appears to be a dummy (positive) current rail 12ft long is fitted to the side of the track. The surface is of stainless steel and beneath are twelve permanent magnets and coils, the magnets being at 9in spacing. The positive shoes of the train run over the inductor and induce a current in the coils. The flux from the permanent magnets is attracted up to the iron shoes as they pass and this causes a variation in the flux reaching the coils below, so that a small a.c. is generated in the coil. The frequency of the current varies exactly in proportion to the speed of the train's passage over the magnets, and hence is a measure of the speed of the train. The current passes through a specially designed valve amplifier and is fed into a relay which has been designed to respond only to a.c. below a given frequency. When the relay operates, the speed controlled signal ahead will clear. A high degree of accuracy, with measurements correct to ½ mile per hour, has been achieved with the speed detector.



Two of Five 2 MW Diesel Sets in Commission

IT is only for a comparatively short time that a public electricity supply has been available in Ashford, Kent. In 1925, the necessary powers were granted to the Ashford Urban District Council and during the following year three Ruston diesel engines, each driving a 400 kW English Electric alternator, were installed in Ashford "A" generating station to provide the first electricity supply in the district. In 1928 a Davey Paxman engine driving a 600 kW alternator was installed followed by an 800 kW set of the same make in 1929. Two years later a Ruston engine driving a 900 kW alternator was commissioned bringing the total capacity of the station up to 3·5 MW. All of the alternators were supplied by the English Electric Co., Ltd.

In 1933 connection was made to the grid substation at Folkestone by means of a duplicate 33 kV line. Owing to the age of the diesel plant and the scrapping of one unit at the end of the war, the output from Ashford "A" is now limited to 2 MW. The 33 kV line is also becoming fully loaded and for this reason it has become necessary to install further generating plant in the district, in the form of Ashford "B" generating station.

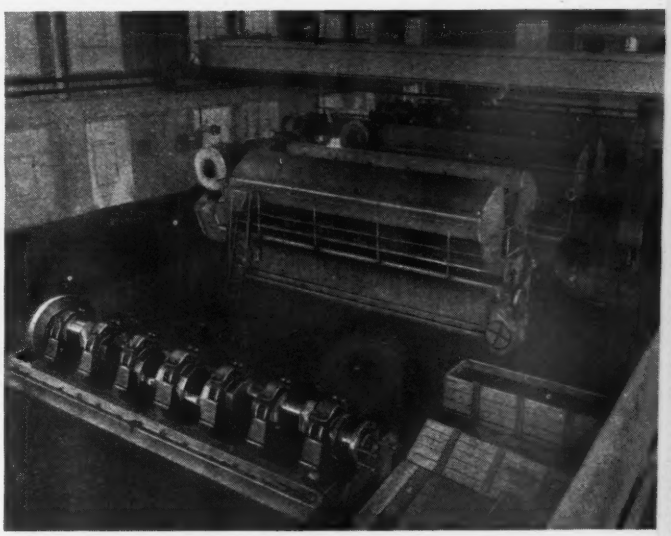
The decision to build the new station was taken shortly after the electricity supply industry was nationalized, when it was decided to initiate a restricted diesel-generating plant installation programme mainly to meet the existing steam plant shortage and to reduce local peak loads. As suitable land was available at Ashford and the staff there had experience of diesel operation it was decided to build Ashford "B" containing five 2 MW sets adjacent to the "A" station. This station, which has been designed for peak load operation only, is now in an advanced stage of construction, two sets having been commissioned; the other three are expected to be completed in the early autumn. This will then be the largest diesel station to be operated by the Central Electricity Authority.

The new station is situated about 250 yd to the west of the "A" station and 150 yd north of the River Great Stour which provides make-up cooling water for the engines. The site is on low-lying ground and is a catchment area from Ashford town which is on a much higher level. Hence, difficulties due to water were experienced during excavation and construction; continuous pumping was essential throughout the whole period.

The main building is about 125ft long by 56ft wide and the foundations are of reinforced concrete. The engine pit is of similar construction but the bottom is in the form of a raft with walls arranged to form a water-tight tank to contain the engine blocks. These are of solid reinforced concrete with 2in anti-vibration cork "Corisil" under and at both ends of each block to minimize vibration of the pit bottom and walls. The total building costs have been kept down by using asbestos cladding for the roof and also for the walls above the brick dado, which is 4ft 6in from ground level.

Adjacent to the south side of the station are three wooden type 50,000 gal/hr induced draught cooling towers which cool the secondary cooling water system of the five diesel

General view of the engine room showing some of the sets during erection

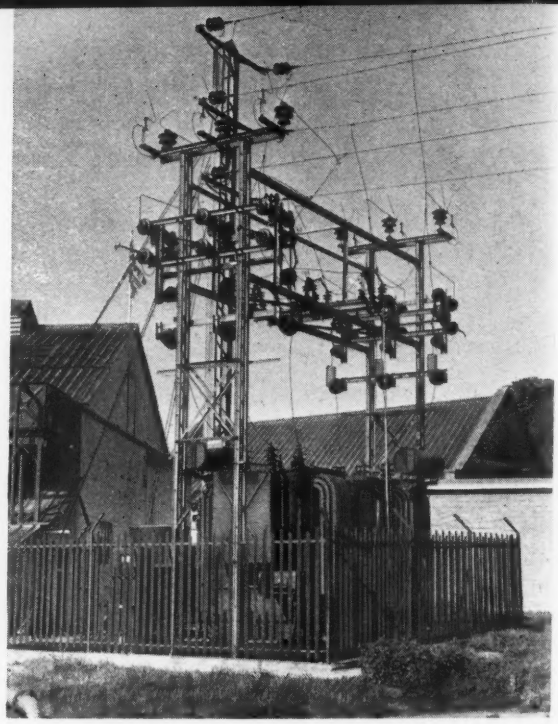


engines. On the other side of the building are four 25,000 gal capacity main fuel oil tanks, a 5,000 gal tank containing a lighter grade of oil for starting purposes, and a 3,250 gal tank for lubricating oil. All of the oil is at present being supplied by Berry Wiggins & Co., Ltd. As it is the ultimate intention to use medium fuel oil (200 secs) for running, a rather heavy grade for diesel engines, the four main tanks are lagged and incorporate heating coils through which hot water is bled from the engine primary cooling water system. The water outlet temperature from the primary cooling system is 160 deg F which is normally sufficient to heat the fuel oil to a temperature of 140 deg F. Electric line heaters are installed in the fuel lines to raise the temperature to the required operating figure of 160 deg F. Sharples centrifuges are used to clarify and purify the heated fuel oil and there is a portable centrifuge of the same make for lubricating oil treatment. This latter machine can be taken to any engine and used even while it is running. For starting purposes normal diesel fuel is used, while lubrication is by Chevron Fulmar Mil-o-2104 specification. Both the fuel and lubricating oil come from Kingsnorth Refinery, near Rochester.

As previously mentioned there will ultimately be five generating sets arranged transversely down the main engine room. At present Nos. 1 and 2 sets are in operation although they are not yet using the heavier grade of fuel since the heating system has only been completed during the past few weeks. Each set comprises a Mirrlees Bickerton & Day, Ltd., twelve-cylinder pressure-charge diesel engine rated at 2,900 b.h.p. at 428 r.p.m., direct coupled to a 2 MW Brush alternator. This engine is the well-known type KVSS, which has only been in production for about two years and operates on the four-stroke principle with open type combustion chambers and direct fuel injection. The cylinders are arranged in "vee" formation in two banks of six, the angle between banks being 45 deg.

The fuel injection pumps and atomizers are of Bryce manufacture, each cylinder having its own pump which can be adjusted independently of the others. The pumps are mounted at the top of the crankcase and the bottom of each cylinder to minimize the length of pipework between pumps and injectors. The fuel oil passes from the daily service tank (500 gal capacity) through a gauze filter in the tank itself and subsequently through a Duplex filter

Each engine is directly coupled to a 2 MW alternator



Connection to the 33 kV lines to Folkestone is made via these transformers

on the engine. A feature of these filters is that they can be changed while the engines are running.

The governor controlling the fuel pumps is of the centrifugal type and it is mounted at the flywheel end of the engine. It is gear driven from the crankshaft and can be adjusted to give speed control between 5 per cent above and 10 per cent below the normal engine speed. An emergency governor is also fitted to provide protection against overspeed, and it is set to operate at about 15 per cent above normal running speed. The engine is also arranged to shut down automatically should there be a failure in lubricating oil pressure. Audible and visible alarms are provided for high lubricating oil and cooling water temperatures and low cooling water flow. Each engine is also fitted with twin "Buchi" type exhaust gas driven turbo-chargers together with twin inter-coolers to lower the temperature of the air after it has passed through the super-chargers.

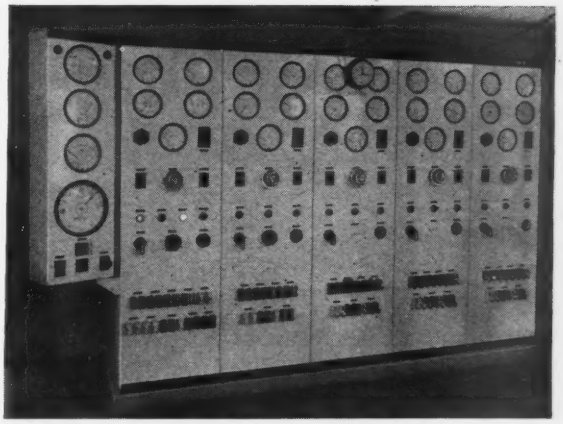
As already indicated, each engine has primary and secondary cooling water systems. The primary system circulates clean soft water through the engine jackets and this circuit is cooled by the use of secondary water in a heat exchanger. The secondary water is cooled in the cooling tower described above. An advantage of this system is that a much improved thermal gradient is obtainable across the engine jackets, resulting in improved running conditions and minimum difference between jacket inlet and outlet temperatures. Moreover, it is also possible to obtain much lower lubricating oil temperatures as the oil cooler is in the secondary circuit which is 30 deg F to 40 deg F lower in temperature than the engine jacket system.

The engine is started by means of compressed air (300 lb/sq in nominal) through the master starting valve and patented timing valves and it can be instantly run up to full speed from cold. The starting procedure is simple as it involves only the operation of a single hand-wheel which has three positions: "start," "stop" and "run." The fuel consumption of each engine is about 0·345 lb/b.h.p.-hr at full load, 0·350 lb/b.h.p.-hr at three-quarter load and 0·372 lb/b.h.p.-hr at half load.

Each diesel engine is direct coupled to a 428 r.p.m.

2,000 kW 0·8 p.f. three-phase 6·6 kV alternator supplied by the Brush Electrical Engineering Co., Ltd. Each machine is fitted with a direct coupled overhung exciter and a Metropolitan-Vickers vibrating type voltage regulator, which is associated with the field suppression cubicle mounted alongside the exciter. From each alternator cable connections are made to a Brush type VA5 six-panel 6·6 kV switchboard. Five of these switches control the alternators while the sixth controls the 400 kVA station auxiliary transformer. In this way each alternator is switched on to a common 6·6 kV busbar from which outgoing power is taken through a reactor to the switchgear in the South Eastern Area Board's substation nearby. The 6·6 kV busbars in the "A" station are also connected to this gear.

The generators are controlled from a five-panel board which is situated centrally on the south side of the engine room together with a synchronizing panel which is common to all five sets. The manually controlled field rheostats are also accommodated on these panels, together with indicating instruments, circuit-breakers and governor control switches, indicating lamps, and synchronizing plug sockets. To the right of this board are the alternator and station auxiliary transformer circuit-breaker panels with protective relays and a single neutral earthing cubicle. Connection to the 33 kV lines to Folkestone is made via two 5 MVA banked transformers and a further 10 MVA unit. All three transformers are fitted with auxiliary forced air cooling and are situated in a compound adjacent to the South Eastern Board's substation. At this substation either the "A" or "B" stations can be synchronized with the incoming supply from this point.

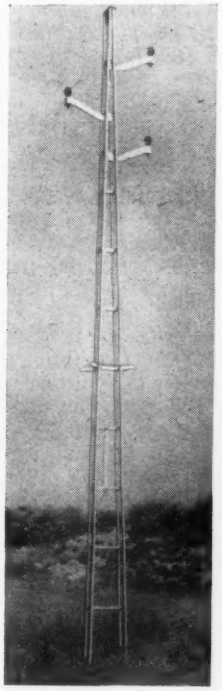


The generators are controlled and synchronized from this panel

The auxiliary supplies are naturally small in a station of this type but switchboards of Brookhirst and English Electric manufacture control the induced draught fans in the cooling towers, water pumps, oil pumps, and compressors, etc.

Acknowledgment is due to Mr. W. C. Parker, divisional controller, South Eastern Division, Central Electricity Authority, for permission to publish this article and to Mr. H. J. U. Collins, the superintendent of Ashford "A" and "B" stations, for his assistance in the preparation of the material.

New Overhead Line Pole



The P.N. pole

A NEW overhead line pole for use on distribution and transmission lines where supports do not have to withstand heavy mechanical loading, has been developed by Painter Brothers, Ltd., of Hereford, in collaboration with British Insulated Callender's Construction Co., Ltd. It will be known as the P.N. pole.

In its design full consideration has been given to the need for economy, lightness and simplicity of construction. These features have been achieved by fabricating the pole from standard commercial sizes of small-bore steel tubing and adopting a bracing system which permits a break-down of the complete pole into component pieces. This, in turn, results in easy transportation and enables the assembly and erection of the poles to be carried out with the minimum of skilled workmen and supervision.

The pole is made in two sizes, 30ft and 35ft overall length, designed for a depth below ground level of 5ft and 5ft 6in respectively. The transverse face tapers from ground line to peak to form an "A" frame with a reverse taper below ground to provide an efficient foundation. Longitudinally the tubes are parallel.

The pole is made from four steel tubes of 1in nominal bore by 12G to Class "A"—B.S.1387. The tubes forming each longitudinal face are connected at intervals by batten plates welded to the tubes and to these battens are bolted spacers, made from rolled steel flats to form "I" sections, which connect the two longitudinal frames together to make the complete pole. The two longitudinal faces are fastened together at the top by a locking unit and a cap plate which are connected by a through bolt or insulator spindle. The cap plate also serves to seal the ends of the tubes from the atmosphere.

All structural parts are hot dip galvanized, bolts being hot dip spun galvanized. The tubes are left open during galvanizing and thus protected both inside and outside.

The pole has been designed for an ultimate head load not exceeding 1,250 lb at the pole top, and has been subjected to full-scale comprehensive tests so that poles are of a guaranteed known strength. Particularly suitable for tropical conditions, these poles will support a wide range of conductors on spans varying between 250ft and 350ft depending on conductor size and material. The pole so far described is not suitable for use as a strut and it cannot, therefore, be used as a stayed structure. A pole for this purpose, of similar construction and embodying the same features, has been successfully proof tested for use at angle and terminal positions.

Engineering in Europe

Abstracts from Foreign Technical Journals

ON the occasion of the erection of a 220 kV line with twin conductor groups in the Black Forest a mechanical testing station was set up on a span of 710 m length, crossing a valley at an altitude of 500 m. The test programme was designed to clarify the following problems: reduction of the vibration tendency of the grouped conductors compared with that of single conductors; positioning and design of spacers; vibration amplitude of grouped conductors referred to that of single conductors; ice-loading conditions of the grouped conductors, particularly possible dangers of the two conductors of the group becoming entangled on the dropping-off of unequal ice-loads; and possible difficulties of erection and tensioning of grouped conductors.

The problem of conductor vibrations is obviously closely connected with the incidence of certain dangerous wind speeds, in this case of 4-8 m/sec, which was determined by anemometric measurements. The results so far available indicate that the tendency for vibrations to be set up is greatly reduced by the coupling of the partial conductors by the spacers, that wind stresses do not cause any appreciable approach of the partial conductors, but that the design and positioning of the spacers is of the greatest importance in this respect. They must be articulated and give the conductors full liberty of longitudinal and transverse displacement. The spacer distances must not be too large. A danger of entanglements of the conductors as a consequence of unilateral ice-jumps does not seem to exist. The erection and tensioning of grouped conductors is hardly more complicated than that of single conductors. Similar tests will be carried out at an altitude of 1,100 m above sea level.—"Mechanical Tests on Grouped Conductors for O.H. Lines," K. W. Baer and H. Mors, *E.T.Z.(A)*, Vol. 76, No. 10, pp. 348-352, 11th May, 1955, in German.

Resynchronization of Generators

The probability of a transition into steady asynchronous operating conditions of a generator which had fallen out of step was considered on the basis of the static characteristics relating the torque of the turbine and the asynchronous torque of the generator with the slip. Average torques and slips were determined from the point of the intersection of these static characteristics. However, operational experience and experiments of generator operation confirmed that a steady asynchronous state exists only when excitation is lost. On the other hand, operational experience has long shown that if the loss of synchronization of the generator is not due to loss of excitation, but to an interruption of the dynamic stability, the generator will in many cases resynchronize itself without any action by the operators.

Tests on a 50 MVA turbo-generator showed that after clearance of a three-phase short circuit on the station busbars, within 0·55 second asynchronous oscillations were set up. The resynchronization of the turbo-generator occurred after 9 cycles of these oscillations, i.e., 4 seconds after the inception of short-circuit conditions.

A 55 MVA hydro-generator tested had no damper windings. In the first test it operated with an excitation regulator and with quick-acting excitation control; in the second test the exciting voltage was kept constant. In the first test the asynchronous conditions lasted about 15 seconds, resynchronization being achieved after 138 cycles of asynchronous oscillations. In the second test resynchronization occurred after 171 asynchronous cycles, whereupon the hydro-generator again lost synchronism when the speed fell below the synchronous speed. After 8 cycles of asynchronous oscillations in this state, i.e., 22 seconds after short-circuit inception, the final resynchronization of the hydro-generator took place. The maximum slip observed in the first test was 28·6 per cent, in the second test, 32·5 per cent. An analysis of the experimental results and comparison with theoretical calculations showed clearly that the decisive factor in the resynchronization process is the inertia of the regulating system of the turbines.—"Experimental Investigation of the Resynchronization of Generators," I. M. Markovich and S. A. Sovolov, *Elektrichestvo*, No. 4, pp. 24-29, 1955, in Russian.

Elastic Modulus of H.V. Porcelain

A method and set-up are described for determining the modulus of elasticity of ceramic materials by a resonance method. Porcelain is a polycrystalline material also comprising a vitreous phase. The crystal phase consists of ionic crystals of β-quartz and mullite, the vitreous phase of feldspar-silica glass and of glass formed in the dissociation process of argillaceous products. In ionic crystals the nature of the forces of interaction between the crystallites is ionic; in glass, however, there are in addition also homopolar and residual Van der Waal's forces.

Assuming a simple crystal type, e.g., of cubic crystal system, a simple expression can be given for the relation between elastic modulus and mechanical strength of the material, also involving the inter-crystallite distance. If the elastic modulus is determined by the resonance method, and using a frequency standard, the error incurred does not exceed 2 per cent, the error in determining relative variations of the modulus with temperature being even smaller; the latter is due to the fact that the variations are determined on the same specimen on which the modulus was determined and the errors made in determining the dimensions and the weight of the specimen are here eliminated.

It is found that the modulus of elasticity and the bending strength are in a linear relation. The empirical formula found by the method of least squares for this relation is $=2{\cdot}35\times10^{-3}\ E-940\ kg/cm^2$. The results obtained by this formula were in very satisfactory agreement with the experimental results of bending tests. The investigation was also extended to ascertaining the influence of the annealing temperature, the structure of the porcelain and the type of glazes used on the elastic modulus and mechanical strength. In addition to the advantages of the method mentioned above, the fact that the true value of the elastic modulus at high temperatures is independent of speed and time of the deformation may also be emphasized.—"The Elastic Modulus of H.V. Porcelain as a Characteristic of its Mechanical Strength," N. G. Drozdov and Yu. S. Chatyinyan, *Elektrichestvo*, No. 4, pp. 53-55, 1955, in Russian.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

WORLD ELECTRICAL MARKETS

West African Survey

By K. H. WIDGERY, B.Sc., A.M.I.E.E.*

THE four Commonwealth territories in West Africa are, in order of size and population:—The Federation of Nigeria and the British Mandated Cameroons; the Gold Coast and British Mandated Togoland; Sierra Leone; and the Gambia. These four territories are separated from each other by French possessions, and whilst maintaining some services in common, are separately governed and are in varying stages of achieving self-government.

All are relatively undeveloped and their economies are tied to agricultural products and to mining. The agriculture (mainly cocoa, groundnuts and palm oil) is almost entirely carried out by small local farmers but most of the mining is controlled by overseas companies, though with increasing managerial participation by Africans. Such local industry as there is, is largely concerned with the processing of local products for local consumption, or with their preparation for export.

Some consumer goods, notably furniture, are manufactured, and there are a large number of small workshops, mostly locally owned, occupied in the maintenance of equipment and in carrying out some minor manufacturing. There is no local manufacture of electrical machinery or equipment and the maintenance and repair facilities available for it leaves much to be desired, mainly because of the difficulty in obtaining competent staff. Two major manufacturing projects are envisaged, a cement factory in the Eastern Region of Nigeria on which work has already commenced, and the aluminium smelting project which is tied to the development of the hydro-electric potential of the Volta River in the Gold Coast which is still under investigation.

Large Unsatisfied Demand

In none of the territories is electrification in an advanced state and there is a large unsatisfied demand, particularly in the towns. Many of the industrial and mining concerns generate their own power, the most important individual scheme being the series of hydro-electric stations on the edge of the Bauchi Plateau, which are operated by the Nigerian Electricity Supply Corporation to supply the tin mines in that area. Public supply is the responsibility of the Government Departments except in Nigeria, where the Electricity Corporation of Nigeria took over the Government undertakings in 1951.

Supply is limited to the larger towns and this condition is likely to continue for many years to come, for the majority of the population live in the rural areas where houses are scattered, and the load demand per consumer seldom exceeds 8-12 kWh per month. At present the territories are enjoying a phase of prosperity with a consequent demand for electricity, not only for the amenities which it can offer, but for the enhanced social standing which is given by a blaze of electric lights and the possession of such electrical apparatus as radio sets and refrigerators. As a result of this, the amount of energy sold in Nigeria has doubled during the last few years, and is likely to double again by 1960, though even then it will represent no more than 10 kWh per head of population per annum. This rate of load increase is not high for an undeveloped territory and it could be bettered were the necessary staff and capital available.

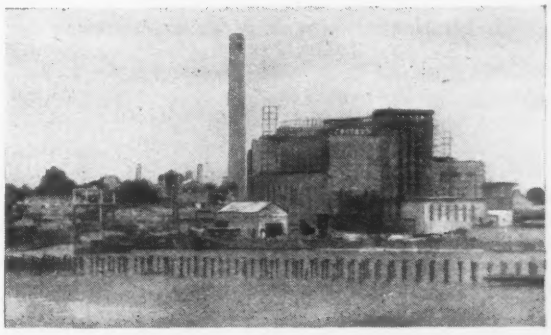
There are a few hydro-electric stations apart from those in the scheme mentioned above. Development in this direction is inhibited by the seasonal nature of the rains and the relatively flat country which makes it difficult to find suitable dam sites and the provision of ample storage facilities is out of the question except in a few places. Unfortunately most of these are remote from the areas where a demand for electricity exists.

Normally, generation is by means of diesel sets, varying in size from the large stations operated by the mining concerns in the Gold Coast with up to 9 MW of Crossley Premier/G.E.C. diesel-alternators, to stations with as little as 50 kW of installed capacity. The Electricity Corporation of Nigeria is building a station at Ibadan with an initial installation of 5·2 MW of National Oil Engine/Brush Electric plant, and recent orders have been placed with Mirrlees, Bickerton & Day for extensions to the station at Accra and with Harland & Wolff for sets for a number of stations in Nigeria.

The Ijora Stations

Steam generation is effectively limited to Nigeria, which has a plentiful supply of local coal. The largest station is the Ijora "A" station at Lagos, with 13·75 MW of Belliss & Morcom turbines driving B.T.H. alternators. The Ijora "B" station has a designed capacity of 75 MW. The initial stage of this station with two 12·5 MW Brush-Ljungstrom turbines, Stirling boilers, Reyrolle switchgear, Parsons transformers and Johnson & Phillips cabling is due for commissioning early in 1956. The consulting engineers for this station, which will be by far the largest on the Coast, are Messrs. Preece, Cardew & Rider for the electrical and mechanical works and Messrs. Coode & Partners for the civil works.

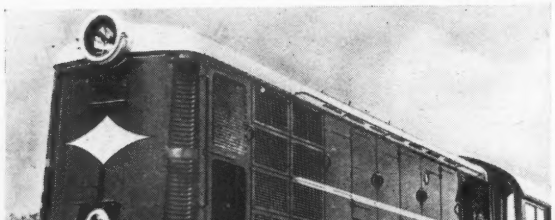
There is little transmission at the moment, apart from that associated with the mining concerns, as the load centres are many miles apart and have not yet been developed to the stage where the capital expenditure would be justified. However, a start has been made in Nigeria, where some 60 miles of 66 kV double-circuit line is being



[Courtesy, *Daily Times*, Lagos

The Ijora "B" power station, Lagos, with the "A" station in the background

* Senior Executive Engineer, Electricity Corporation of Nigeria.



Diesel-electric locomotive supplied by the English Electric Co. for the Nigerian Railways

erected on B.I.C.C. " P.B." poles to take the output of the new Oji River power station which will feed Onitsha, the coal mining centre of Enugu, and the new cement works mentioned above. There are also a number of 33 kV lines under construction, partly on " Adastra " poles and partly on locally manufactured pre-stressed concrete poles.

Distribution is almost entirely overhead with the lines carried on locally made reinforced concrete poles, though there is a certain amount of line on B.I.C.C. " P.B." poles. Local manufacture of pre-stressed and spun concrete poles in Nigeria will mean that future development will be for the most part on locally-produced poles. Wooden poles are little used owing to the prevalence of termites.

Until very recently the railways were run entirely with steam locomotives, but both in the Gold Coast and Nigeria, English Electric diesel-electric locomotives are now coming into service.

Trading Methods

The bulk of the electrical equipment used, apart from that imported direct by the public utilities, is marketed through one or other of the large trading companies which maintain depots throughout the territories. This system works quite well, particularly where the company concerned has an adequate technical section to deal with the equipment. However, many manufacturers find it advantageous to have a member of their own organization attached to their agents, both to ensure that the promotion of the sales of their product does not take a back place amongst the many agencies handled by the companies, and to ensure that full and up-to-date technical information is readily available to prospective and past customers.

This combination of a large agency company with adequate coverage of the territory and with the requisite administrative and handling facilities and direct technical representation has much to commend it. Where a manufacturer considers that the volume of trade does not justify a permanent representative in the territory, occasional visits to the Coast by one of his engineers, arranged in conjunction with his agents, will be of considerable value.

With the possible exception of a manufacturer of large equipment for which there is a limited number of potential customers, the technical representative operating by himself is at a considerable disadvantage. Housing, office and storage accommodation will be a problem, both in the town in which he is based and when he is touring the territories. With the area to be covered and the limited communications available he will find it almost impossible to ensure adequate promotion of his company's products. Follow-up service, which is of vital importance in building up sales, and the supply of spares will present him with a very real administrative problem.

Catalogues and lists of recommended spares should be clear, and concerned more with presenting facts in a readily understandable form than with supplying a highly artistic representation of the equipment with a few vague generalities about it. Exploded diagrams of the plant, clearly labelled, are of inestimable value in ordering spares, and would avoid lengthy time-wasting correspondence when ordering. Maintenance handbooks should be detailed and as straightforward as possible: in general the maintenance engineer has to be a jack of all trades and is unlikely to be an expert in any.

Handbooks which give a few general instructions and then say " refer to our nearest agent " are worse than useless to the engineer on some remote outstation with a piece of equipment out of order and the nearest agent some hundreds of miles away over roads that are closed because of the rains. Many British manufacturers would be well advised to study the catalogues and maintenance handbooks issued by their American and Continental competitors.

Packing needs to be robust and weatherproof: it is not unusual to see a packing case off-loaded by the simple method of pushing it off the tail of a lorry or to be moved by tipping it over and over. Equipment liable to be damaged by water should be given adequate protection, as rain at the rate of four or five inches an hour can cause considerable damage. With a relative humidity of over 90 per cent for most of the year, hygroscopic materials should be avoided as far as possible. Cable and conductor drums and such items should be treated to withstand termite attack: re-drumming a 400 yd length of 0·2 sq in three-core 11 kV cable whose drum has collapsed and is lying on its side is an expensive and time-consuming job quite apart from the risk of damage to the cable.

The Ministry of Supply maintains a Tropical Testing Establishment in Port Harcourt in Nigeria and manufacturers contemplating entering the West African market would be well advised to obtain their advice upon the suitability of their product for local conditions.

Submerged Repeaters

For use in the transatlantic telephone cable now being laid Standard Telephones & Cables, Ltd., have developed a submerged two-way repeater for deep sea use. This is contained in a torpedo-shaped housing with special glands at both ends for the necessary coaxial cable connections. It can withstand the full cable tension during laying and can therefore be paid out on to the sea bed as an integral part of the whole.

Compared with repeaters for land coaxial cables the new submerged repeaters present novel features. For instance, each is a three-stage amplifier with negative feedback, but the submerged repeater amplifier is arranged to serve both directions of transmission, one direction by a group of low frequencies and the other by a higher frequency group. Alarm and supervisory facilities provided in association with these repeaters include a means of measuring the efficiency of each repeater section from the terminal stations. This is done by means of test frequencies for individual repeaters which are frequency-doubled after amplification and then transmitted in the opposite direction, back to the originating station, where they provide a means of measuring the degree of amplification effected. Power supplies for repeaters are carried through the central conductor of the coaxial cable.

VIEWS on the NEWS

By REFLECTOR

QUITE frequently cases of profiteering in the sale of electricity by landlords come to my notice. A correspondent to the *Birmingham Evening Despatch* mentions that on holiday she took a furnished house and was appalled at the fantastic amount of money she had to put in the meter for very little electricity. It seems that the landlord had his own meter and paid accounts quarterly but he had installed a special tenant's coin-operated meter adjusted to 4d/kWh. The writer of the letter managed by protesting to have the rate reduced to 2d/kWh but she says that in Birmingham she has found landlords charging tenants as much as 6d. The practice, although reprehensible, is within the law but it would be pleasing to see measures taken to stop it. Already the subject has been raised in the House of Commons but with no success.

* * *

A *Daily Mirror* reader says that to relieve her during the hot weather her husband has fixed about ten yards of extra flex to her electric iron. This enables her to take her ironing board into the garden and do her work in the open air. I am not surprised at a footnote to her letter which says that the arrangement is not approved by the London Electricity Board.

* * *

The writer of a letter to the *Derby Evening Telegraph* who says she is " an old lady of 88 " has come up against what (to her) is a meter conundrum. She says that she had to leave her home on account of illness and upon her return found it necessary to put 9s 6d into her electricity prepayment meter before she could get any light. The East Midlands Electricity Board explained to the newspaper that this was a fixed charge collection type of meter and apparently it ticked away all the time the lady was absent. An investigation of the case has been offered but I suppose the fixed charge has to be paid anyhow although I can imagine that to have to pay it in a lump can be disconcerting to one who has been used to gradual payment.

* * *

Besides the power produced in joint irrigation and hydro-electric schemes there is an indirect electrical interest in the work being carried out in various parts of the world to restore desert lands to fertility. Recently, an absorbing documentary film in the series " The World is Ours " in the B.B.C. Television Service, showed how hitherto barren wastes in Russia, Pakistan, and particularly in the Negev in Israel are now producing worth-while crops. Apart from irrigation, the cultivation of the desert requires the sowing of special grasses to prevent erosion and experiments at present being carried out in this country on the growing of grass and clover on power station ash tips may well result in the production of special types particularly suitable for this work. At Hams Hall, on a 1½-acre ash tip, two crops have been obtained in one year, and experiments are being carried out with five kinds of grass and two of clover to determine the best variety for growing on pulverized fuel ash without soil or sludge.

* * *

Several times in the past I have made it clear that those who protest against the erection of overhead lines do not always go unanswered by others than the electricity authorities. Sometimes the defenders of the transmission line towers are positively lyrical—Mr. A. C. Hyde Parker, who writes to the *Daily Telegraph* for instance, " To me," he says,

> " they are a real joy to look at, whether shining in the sun or peeping through the mist. It is most heartening to see that an object so completely functional in design, and made entirely of steel members and possibly with no concession to any æsthetic consideration (I hope I am not being unjust to someone) should be so satisfactory . . . . To me the first aspect suggests a Chinese pagoda, but the lasting impression is of giant snowdrops in the graceful way the arms carry the insulators."

Mr. Parker *is* being unjust to someone: to Sir Reginald Blomfield whose æsthetic and artistic qualities were called upon in the design of the " pylons " (as was pointed out in a letter from Mr. O. A. Sherrard, former secretary to the Central Electricity Board). In all honesty, I must record that a very different attitude towards pylons is expressed by Lord Hazlerigg in the same issue of the *Daily Telegraph*.

* * *

An Edinburgh correspondent (Mr. J. Walker) has sent me a cutting of an advertisement from the *Edinburgh Evening News* which offers an " electric fire bargain, 1000 k.w. reflector type, 18s 11d." This should prove useful for a small housing estate; no municipal authority could jib at the cost.

* * *

Seventy years ago the *Electrical Review* had to take the City of London to task for its tardiness in adopting electric lighting. In the issue of 29th August, 1885, it was said that

> ". . . one would have expected that the very best means of illuminating the modern beauties of the City and its vast outgrowth would have been adopted as soon as it was discovered that there was a better system than that in vogue. Yet whilst other towns are making attempts in this direction, and private prescience is manifesting itself in instances increasing in number every day, we see only the most insignificant efforts made in the Metropolis of the World to have its streets lit by the one effective means of illuminating during the dark hours of the night those features of interest which deservedly command so much attention whilst the light of day shines upon them. There is a social side to this question, for in many American towns the brilliant light has been found of rare virtue in suppressing evil-doing of many kinds . . . . "

The reference to " the Metropolis of the World " will be particularly noted.

New Books

Magnetic Control of Industrial Motors. By Gerhart W. Heumann. Pp. 714; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 86s.

The modern electric motor is a fairly standardized and reliable piece of apparatus, and has not been subject to a great deal of development during the past few years. Most of the recent advance in motor circuits has been in the control gear, and has been with the object of making the operation of motors more automatic, more fool-proof, and more flexible.

This second edition is an up-to-date record which deals with the performance of various types of electric motors, and various methods of controlling the required operations by means of electromagnetic devices. The operating and braking characteristics of d.c. and a.c. motors under various conditions are thoroughly dealt with, and this section should be very useful to engineers who are concerned with the application of motors to various drives, irrespective of the control gear to be used. The different methods of controlling the speed of d.c. and a.c. motors are explained, including power selsyn, Kraemer, Scherbius and frequency-changer sets for a.c. motors. The book deals also with constructional features of contactors, relays, overload relays, time delay relays, fuses, circuit-breakers, rectifiers, capacitors, thermostats and other auxiliary devices, as well as with complete controllers.

Features which are of special interest in this edition are the information relating to adjustable voltage and regulating systems, and various types of rotating amplifiers used to control a motor in rapid response to a control signal; also the feedback or closed-cycle control systems in which any deviation from a pre-set standard is employed to reduce that deviation. Electronic devices are dealt with in less detail.

The symbols used in this book are those approved by the American Standards Association, as detailed on pages 7, 8 and 9. Wherever possible the "per-unit" system has been used to show the performance of motors and controllers, quantities being expressed as a ratio of some basic quantity such as full-load current or synchronous speed. The book can be highly recommended.—J.L.W.

Electroplating Engineering Handbook. By A. K. Graham. Pp. 650; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 80s.

In Great Britain it is normal for a plating department or plant to be controlled (technically) by a "plating chemist" while in America they always have a "plating engineer." Though both titles are to some extent synonymous, the English plating technician is normally more of a chemist and less of an engineer than his American counterpart. As the scale of electroplating increases and plants become more highly mechanized, the need for sound engineering practice becomes more and more important; while on the other hand as an increasing number of modern proprietary plating processes are being introduced, the chemical control, apart from simple routine testing, can be left more and more in the hands of the supply houses. This change of emphasis in plating departments, from chemistry to engineering, is no doubt gradually occurring in this country too; and this book with its emphasis on engineering should prove most valuable here, where our own handbooks have tended to emphasize the chemical side.

This book, which has been prepared by a staff of specialists—nearly all well-known figures in the electroplating industry in the United States, contains rather wider information than is usually found in "handbooks." After some 50 pages of "Tables of Data," there follow 14 chapters on "General Processing Data" and 21 on "Engineering Fundamentals and Practice." The "Processing" deals with surface preparation for plating, composition and analysis of plating and anodizing baths, etc., plating specifications and testing methods, safety measures, costing and waste disposal; while the "Engineering" includes layout of plant, plating tanks, manual, automatic and barrel plating installations, and heating, cooling, exhaust, filtration, rinsing and drying equipment, as well as chapters on the supply and distribution of the current required for electrocleaning, plating and anodizing.

One chapter is devoted to d.c. generators, mainly details of maintenance, and one to metal rectifiers (which because of fire insurance regulations, are usually air-cooled in the U.S.A. and not oil-cooled as they are here). Separate chapters are also devoted to "Anode and Cathode Rod and Bus Systems" and "Plating Racks," while there is another chapter solely on the design of the anodes and cathodes used for various processing tanks. Information is included on the most suitable types of contacts for carrying the low voltage d.c. to the electrodes and on the effects of rack design and the positioning of the work and anodes on the distribution of current (and consequently the coating thickness) on the articles being plated—very useful detailed information, not often found in either handbooks or textbooks.

All through the book one finds well written chapters or sections which might be entitled "Educational Sections"; for example the chapters on "Metallurgy for the Electroplater" and "Design for Electroplating," and large sections of the chapters on "Electropolishing," "Barrel Finishing," "Periodic Reverse Current Plating," etc.—S.W.B.

Television Receiver Servicing, Vol. II. Receiver and Power Supply Circuits. By E. A. W. Spreadbury, M.Brit.I.R.E. Pp. 308; figs. 172. Trader Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1. Price 21s.

This is the second volume of a comprehensive book written for radio service engineers who wish to obtain a thorough knowledge of television servicing work. It assumes that the reader already has a reasonably good grasp of the principles of radio servicing, and it extends these to the more complex circuits and techniques of television.

The first volume covers the time-bases and their associated circuits only. This second volume deals with all the other sections of the modern receiver, including the video stage, tuning circuits, sound channel, power supplies and aerial arrangements. Attention is also paid to such matters as vision interference suppression, the various multi-channel tuning systems now in use, vision automatic gain control, and the problem of reflections and "ghosting." A final chapter gives much valuable information on the technique of circuit alignment.

The text is presented in a practical and straightforward manner, and the numerous illustrations include a wide variety of actual circuits, each of which is discussed in detail.

BOOKS RECEIVED

Radar and Electronic Navigation. By G. J. Sonnenberg. Second edition. Pp. 288; figs. 81. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 31s 6d.

Foundation Engineering. By Rolt Hammond, A.C.G.I., A.M.I.C.E. Pp. 192; figs. Odhams Press, Ltd., Long Acre, London, W.C.2. Price 21s.

Practical Electroacoustics. By M. Rettinger. Pp. 271; figs. 178. Thames & Hudson, Ltd., 244, High Holborn, London, W.C.1. Price 63s.

Transistors. By T. R. Scott, D.F.C., B.Sc., M.I.E.E. Pp. 258; figs. 65. Macdonald & Evans, Ltd., 8, John Street, London, W.C.1. Price 45s.

Electrical Measurements and Measuring Instruments. By E. W. Golding, M.Sc.Tech., M.I.E.E., M.Amer.I.E.E. Fourth edition. Pp. 913; figs. 550. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 40s.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Fuel and Power has appointed **Mr. E. L. Gethin,** B.Sc., A.M.I.E.E., supplies and production adviser, British Transport Commission, as a member of the Industrial Coal Consumers' Council.

George Ellison, Ltd., and Tufnol, Ltd., announce that in future the sales and engineering service for "Ellison" electric switchgear and "Tufnol" in Canada will be handled by the Electric Construction Co., Canada, Ltd., 1947, Avenue Road, Toronto, 12. The president and managing director of Electric Construction Co., Canada, Ltd., is **Mr. H. Copping,** M.I.E.E., who was associated with George Ellison, Ltd., for twenty-five years. He was manager of their Scottish area sales office, Glasgow, from the date of its opening until 1938 and manager of the Leeds area sales office from 1938 to 1950.

Mr. H. Copping

Mr. W. Plumb has been appointed deputy commercial manager for the Liverpool and Netherton Works of the English Electric Co., Ltd. For the last six years Mr. Plumb has been manager of the Leeds Branch office of the company. **Mr. A. J. Evans,** who succeeds him at Leeds, served a student apprenticeship at the English Electric Stafford Works and until the last war was attached to the Bristol, Manchester and Southampton branch offices. On returning from military service he was placed in charge of the Tonbridge office, and before his new appointment was at the London Branch.

Mr. D. J. Bolton, M.Sc.(Eng.), M.I.E.E., M.Amer.I.E.E., retires from the Central Electricity Authority at the end of this month after five years in the Commercial Department. He joined the Authority following seven years in the Ministry of Fuel where he served in the Fuel Efficiency and Electricity Divisions, and acted as secretary successively of the Fuel Efficiency, Heavy Electric Plant and Clow Committees. Previously he was a lecturer at the Regent Street Polytechnic. Educated at Nottingham High School and University College, Mr. Bolton is an old Metropolitan-Vickers apprentice, and his early experience was gained in the commercial offices of that company and the English Electric Co., Ltd. Mr. Bolton has been a member of the Council of the Electrical Research Association, a member of the London and Home Counties J.E.A., and of the Measurements Section Committee of the Institution of Electrical Engineers. Over the past thirty years he has contributed ten papers to the I.E.E. dealing with economic and tariff aspects of the industry, the latest being "A Criterion of Distribution Cost." He is author of a number of books and other writings and has contributed to the *Electrical Review*. He is taking up work as a consultant with Kennedy & Donkin.

Mr. Ivor Davies, B.Sc., A.M.I.E.E., has been appointed district engineer for the Liverpool South District of the Merseyside and North Wales Electricity Board, and will take up his duties on 1st September. At present he is a district engineer at Aberdare with the South Wales Electricity Board.

Mr. Davies received his technical training at the University College of Cardiff where he obtained the B.Sc. degree in electrical engineering. Before going to the South Wales Board he was an assistant planning engineer with No. 4 Sub-Area of Manweb for a little over three years, and had previously had experience with the Southern Electricity Board in its Slough District and at Salisbury. His earlier experience was gained as a junior scientific officer in the Telecommunications Research Establishment at Malvern and with the Wessex Electricity Co.

Mr. F. Spencer, who has for many years been a director of Opperman Gears, Ltd., of Newbury, and who is at present managing director of the Hotpoint Electric Appliance Co., Ltd., will shortly be vacating the appointment of managing director of the Hotpoint Company, although remaining on its board in a consultative capacity. He will become an executive director of Opperman Gears, Ltd., concerned particularly with the future development and widening of that company's activities.

Mr. F. Spencer

Mr. C. G. Derbyshire, B.Sc.(Eng.), M.I.R.S.E., who has been appointed assistant signal engineer (modernization), British Railways (London Midland Region), began his railway career in 1918 as an apprentice in the Chief Civil Engineer's signal department of the former Great Eastern Railway, and after various positions became development assistant to the signal and telegraph engineer in 1937. In 1941 his services were lent to the Ministry of Supply when he held the appointment of assistant director, Directorate of Royal Engineer Equipment. He returned to the Signal and Telegraph Engineer's Department, L.M.S.R., at headquarters, in 1943. He became divisional signal and telecommunications engineer, Manchester, in 1948.

Consequent upon the retirement of **Mr. A. W. Sweetinburgh,** A.M.I.E.E., A.M.C.T., **Mr. P. K. Davis,** M.I.E.E., has been appointed transmission engineer, Eastern Division of the Central Electricity Authority, with effect from 1st October next. Mr. Davis, who has been senior assistant transmission engineer, Eastern Division, since vesting day, was previously outside department superintendent of the Northmet Power Co., construction engineer and mains superintendent, Electricity Board for Northern Ireland, and assistant engineer, Merz & McLellan. He received his education and training at the Hereford Cathedral School and Faraday House.

Mr. P. K. Davis

Mr. C. M. Nesbitt, sales director of Dorman & Smith, Ltd., and D. S. Plugs, Ltd., is retiring from both companies as from 31st August. **Mr. D. Kinnell,** the present export manager, has been appointed to succeed him as sales manager to both companies.

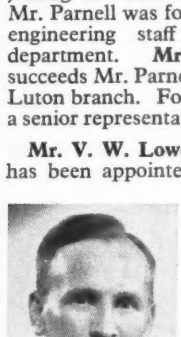
Mr. Gilbert Dodd has been appointed to the board of Monsanto Plastics, Ltd., a wholly owned subsidiary of Monsanto Chemicals, Ltd. Mr. Dodd has been general manager of Monsanto Plastics, Ltd., since its formation.

The Minister of Fuel and Power has appointed **Mr. G. L. Curnow,** F.C.I.S., of Cardiff, as chairman of the South Wales Electricity Consultative Council as from 1st October, in succession to **Mr. C. L. Hilton,** M.I.Mech.E., M.I.Chem.E., of Newport, Mon., who is retiring at his own request on completion of his term of office. Mr. G. L. Curnow has been a member of the Council since its inception and deputy chairman since 1952.

Mr. J. F. Parnell, formerly manager of the Luton branch of Enfield Cables, Ltd., succeeds **Mr. J. Adamson** as

manager at Birmingham. Mr. Adamson has taken up an appointment at the company's London office. Before joining the Enfield sales organization Mr. Parnell was for many years on the engineering staff of the contracts department. **Mr. A. B. Chaplin** succeeds Mr. Parnell as manager of the Luton branch. For many years he was a senior representative at the branch.

Mr. V. W. Lowe, B.Eng., M.I.E.E., has been appointed chief engineer of Erskine, Heap & Co., Ltd. Mr. Lowe, who was educated at Liverpool Collegiate School and the University of Liverpool, served an apprenticeship with Ferguson, Pailin, Ltd., and was later in their Research Department. He then became senior electrical engineer at the Huddersfield works of the I.C.I. Dyestuffs Division, and has been for six years chief engineer, Switchgear Division, of the Brush Electrical Engineering Co., Ltd.



Mr. V. W. Lowe

Mr. Walter Grainger, M.Inst.F., and **Mr. John Mayer,** B.Sc., A.M.I.Mech.E., have been appointed joint managing directors of International Combustion (Holdings), Ltd., as from 22nd August. Both have been with International Combustion, Ltd., for over thirty years.

Mr. J. D. Hammond has joined the technical staff of Printing Paper Drives, Ltd., and will be responsible to Mr. J. M. Simms, managing director, for the company's paper mill business. Mr. Hammond was previously with Crompton Parkinson, Ltd., latterly as branch manager, Home Counties (Chelmsford). He will operate from 19-21, Farringdon Street, London, E.C.4.

Mr. R. O'Donoghue, who writes in this issue on "Heat Treatment Problems," joined the Technical & General Advertising Agency, Ltd., as a copywriter after serving in the Royal Artillery from 1939 to 1945. Later he became publicity manager with J. Collis & Sons, Ltd., until his present appointment in 1945 as publicity manager with Wild-Barfield Electric Furnaces, Ltd.

Mr. R. O'Donoghue

Mr. A. H. Emerson, A.M.I.E.E., M.I.Loco.E., electrical traction engineer, Manchester electrified lines, has been appointed assistant electrical engineer (modernization), British Railways (London Midland Region), Derby. Mr. Emerson was educated at Kings School, Grantham, and Kings School, Peterborough, and received his training in mechanical and electrical engineering on the former L.N.E.R. After holding various positions he was appointed resident electrical engineer for the Manchester-Sheffield-Wath electrification scheme in 1950. In the following year he became electric traction engineer for the Manchester electrified lines, and since that time he has been associated with the erection and commissioning of the Manchester-Sheffield-Wath electrification which went into commercial service as a complete scheme in January this year.

Alderman Frank H. Stone, Great Yarmouth, has been appointed deputy chairman of the Eastern Electricity Consultative Council.

OBITUARY

Mr. W. A. van Heijningen.—The death occurred on 3rd August, at the age of seventy-four, of Mr. Willem A. van Heijningen, managing director of the N.V. Splendor Gloeilampenfabrieken of Nijmegen, Holland, from 1919 to 1946; he was also a director of the Splendor Lamp Co., Ltd., of London, until the time of the invasion of Holland in 1940.

Mr. H. Gwyn Morgan, manager of the Swansea branch of the General Electric Co., Ltd., died recently at the age of sixty-one. Mr. Morgan joined the Cardiff branch of the company in 1934, after a considerable period with a firm of South Wales electrical contractors. In June, 1935, he was transferred to the Swansea branch as manager of the Installation Supplies Department and assistant to the branch manager. He was appointed branch manager in Swansea in 1950.

Mr. H. Simpson.—Hoover, Ltd., announce the sudden death on 15th August of Mr. Harry Simpson, one of the company's senior sales managers. He had been with the company for thirty-two years.

WILLS

Mr. W. F. Bishop, C.B.E., a director of W. T. Henley's Telegraph Works Co., Ltd., former chairman of the Cable Makers' Association, who died on 27th April last, left £86,763 gross (£83,684 net). Among his bequests were £1,500 to form the Walter F. Bishop Bursary, the income to be applied for the educational benefit of employees, of 23 years of age or under, of W. T. Henley's Telegraph Works Co., Ltd., or for the children of similar ages of employees of the company, and £100 to the Electrical Industries Benevolent Association.

Mr. J. H. Jepson, F.C.A., former director of Morecambe Electrical Equipment Co., Ltd., who died on 27th April last, left £44,169 gross (£43,426 net).

Mr. T. A. Kerr, M.I.E.E., a former engineer and manager of the Stretford and District Electricity Board, who died on 26th April last, left £5,917 gross (£5,846 net).

Mr. J. R. Buck, director of Green and Smith, Ltd., electrical contractors, who died in March last, left £9,046 gross (£8,485 net).

Mr. W. Jameson, director of the Carrier Engineering Co., who died on 30th May last, left £131,957 gross (£131,814 net).

RADIO SHOW DISPUTE

The opening of the National Radio Show at Earls Court had to be postponed this week from Wednesday to to-day (Friday) because of a dispute between the organizers of the Show, the Radio Industry Council, and electricians employed in its preparation.

Members of the Electrical Trades Union demanded an extra 5s a day expenses allowance and also that employees of the B.B.C. engaged on work at Earls Court should be members of a union affiliated to the T.U.C. The latter demand was temporarily dropped but work was suspended for several days in support of the wages claim.

Eventually an agreement was arrived at between the E.T.U. and the National Federated Electrical Association (the electrical contractors' labour organization). By this it was agreed that N.F.E.A. members should pay the 5s a day from 22nd August in lieu of the extra 2d an hour exhibition allowance already being paid. This was described as a "temporary settlement"; both parties agreed to submit their cases for and against extra payments in respect of exhibitions at Earls Court and Olympia to the Ministry of Labour for arbitration. It is believed that the Radio Show will have to close on the date already fixed—3rd September.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £171 0s 0d
COPPER, H.C. Electro	ton £374 15s 0d
Fire Refined 99·70%	ton £373 0s 0d
Fire Refined 99·50%	ton £372 0s 0d
COPPER Tubes ..	lb 3s 6¼d
Sheet	ton £445 10s 0d
H.C. wire and strip ..	ton £422 15s 0d
LEAD, English ..	ton £106 7s 6d
Foreign	ton £105 0s 0d
MERCURY	flask £95 0s 0d
TIN, block (English) ..	ton £748 10s 0d
ZINC, G.O.B. Foreign	ton £89 7s 6d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2s 9¾d
Sheet	ton £346 5s 0d
Wire	lb 3s 4¼d
PHOSPHOR BRONZE Wire	lb 5s 1½d
PLATINUM	oz £29 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 41¼d—41½d

Distribution Improvements

The North Eastern Electricity Board is to spend £145,000 on improving the electricity supply in the Horden Colliery area. The Board has taken over responsibility for supplying the area from the National Coal Board.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Electricity in Central Africa

I NOTE in the *Electrical Review* in an article entitled "The Central African Federation" by Mr. F. B. D'Enis, it is stated that the sales of electricity in Salisbury, Southern Rhodesia, have risen from 45 million kWh for the year ended June, 1945, to a figure of 181 million for the current year. This figure is considerably understated and should read 220 million kWh, the figure of 181 milion being for the year 1953.

It is also stated that the consumption per domestic consumer is amongst the highest in the world, and perhaps from your own information you may be able to find whether this statement is correct, as the domestic consumption per consumer in Salisbury is over 10,000 kWh per annum.

Salisbury, S. Rhodesia. J. E. MITCHELL,
City Electrical Engineer.

[Statistics of per capita consumption of electricity in particular cities are not readily available. The figures for countries can be obtained but these do not constitute a basis of comparison. We are sure, however, that Salisbury's claim to have one of the highest figures is fully justified.—Editors, *Electrical Review*.]

Modern Meter Testing

I NEVER regarded my letter on the above subject as an attack on Mr. Petch or his staff. In view of his comment that my letter comes near to "damning with faint praise," may I again compliment him and his staff on the design and construction of a very excellent piece of testing equipment.

Personally, I see no objection whatever to testing meter registers separately and completely, if this can be done at an economic price. I am firmly of the opinion, however, that a final check of the complete meter should be made by measuring energy throughput against energy registered. The designers of the 1936 Meters Act showed wisdom in insisting on this in the three prescribed methods. I believe that to abolish a dial test could lower standards of accuracy.

There was no self-deception or intent to deceive others that the present dial test checks the whole of the train. I merely stated a fact of experience which I thought relevant: that gears were inaccurate in spite of the gate box checking at the manufacturers' works and that the dial test detected the effect in this case. I did not state that it was "typical" of manufacturers to deliver meters with faulty gears; it was a most unusual error, but it did and can happen.

I would assure Mr. Petch that I neither hallow past practice nor ignore the lessons of experience.

Manchester, 8. E. ROSCOE.

Handling Motor Frames on Machine Tools

A MACHINE tool operation sequence for the automatic loading and unloading of electric motor frames is described in the following notes. The first-operation machining is carried out on a Gisholt No. 12 hydraulic automatic lathe equipped with a special boring carriage which is hydraulically operated with rapid approach, infinitely variable speed forward feed and automatic return. The motor frame height is first established because the feet are already milled and drilled. The operator slides the frame from the conveyor on to the machine carriage table, and a guide rail assists in rough positioning. Spring loaded studs are manually raised and enter holes in the two frame feet nearest the headstock to accurately place the frame for machining. When this has been done, the overhead clamp may be actuated. As soon as the frame is clamped, the electrical circuit is cleared and the machine motor is started. The clamp and motor are push-button controlled out of the clamping "danger" zone. The traverse and feed cycle is started by raising the regular starting control lever.

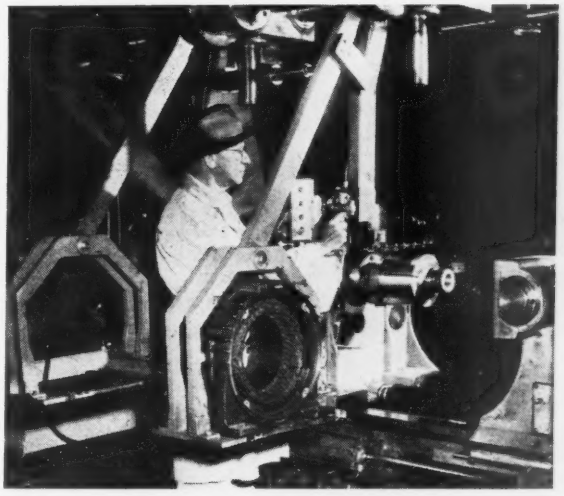
The frame traverses to position and then feeds forward, engaging a special rotating cutter head mounted on the machine spindle which bores the stator laminations. Angular ports in the rotating cutter head permit vacuum chip removal through the back of the spindle. When boring is completed, the spindle stops and the frame moves with reverse traverse to the unloading and loading position, completing the cycle. Six different frame sizes are handled in minimum change-over time, the floor-to-floor time for the No. 284 and No. 286 frame sizes being only 1·1 minutes.

The motor frames are then taken by conveyor to a special "Gisholt Simplimatic" automatic lathe which is equipped with two vertical slide housings, each arranged for two facing slides and two boring slides. One finish facing slide and one finish boring slide are mounted on each housing for this operation. The second-operation machining consists of finish boring and facing rabbet end shield fits at both ends of the frames.

A special overhead mounted, hydraulically-operated loading-unloading device is designed to step up production by reducing handling time. Positioning is from the edge of the frame with a manually-operated swinging stop. The loading cradle then clears the work and the machine and the left-hand traversing slide housing moves in to support the mandrel.

Tools on the rear slides of both slide housings finish both outer faces while tools on the lower boring heads finish bore the rabbet diameters and chamfer. When machining is completed, the left-hand traversing slide housing retracts and the expanding mandrel releases as the operator actuates the air valve to swing the unloading cradle into position to pick up and remove the part.

Change-over is quick for the different frame sizes, and removable shoes assist in locating and loading different size frames in the machine. A manually-operated crank controls longitudinal positioning of the outer vertical slide housing for different frame sizes.



This view of the automatic lathe shows the unloading cradle after it has moved out with the motor frame and cleared the machine and the next cycle

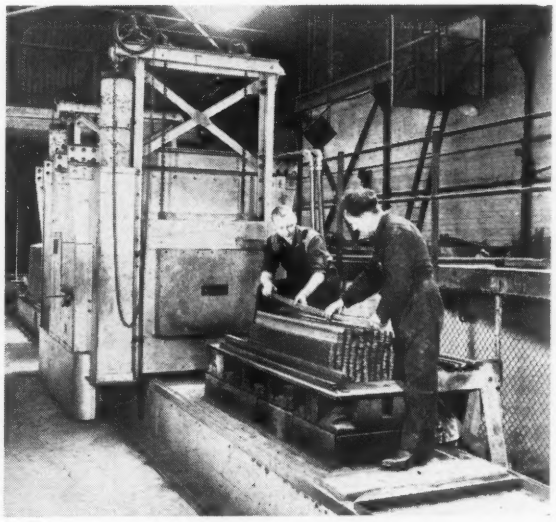
Mobile Bright Annealing Furnace

A MOBILE furnace mounted on four wheels and which travels along rails to any one of four working positions is the latest addition to the bright annealing plant at the wire mills of Bruntons (Musselburgh), Ltd. The furnace, designed and supplied by the General Electric Co., Ltd., is used to bright anneal lengths of cold rolled mild and carbon steel strips and has doors at both ends. Driven by a chain and sprocket through reduction gears from a hand winding unit it can be moved by a single operator.

At each of the four working positions is a furnace base with a refractory hearth capable of supporting a charge of steel strip in lengths up to 7ft, stacked to a depth of 2ft and a width of 2ft. To permit adequate heat transfer to the base of a charge the hearth has a chequered formation. For bright annealing the charge is sealed within a heat-resisting steel hood with down projecting flanges which sit in sand channels round the base. The use of four bases makes possible a continuous cycle of operations comprising the loading and unloading of bases, the purging of each new charge with protective atmosphere, heating and cooling.

The furnace is heated by heavy gauge nickel chrome ribbon elements arranged in sinuous form and mounted in the roof, side walls, and doors. To minimize heat losses the doors are clamped into position against the furnace end plates both of which have machined surfaces. The doors and the furnace body, like the hood, have down projecting angles seating in sand channels round each base, and the doors are suitably counterbalanced to allow easy operation from the side.

The protective atmosphere, pipework and electric power lines are housed within the furnace track. Electrical contacts are made automatically when the furnace is moved to a base. The furnace and its charge are protected from accidental over-heating during operation by an excess temperature fuse. Door switches ensure that all current to the furnace is removed immediately either door is raised. A signal lamp provides a visual indication that the furnace has been accurately positioned over a base while an aural alarm guards against accidental movement of the furnace before the control circuit connections are broken. Operating temperatures up to 850 deg C are provided by the furnace which is fitted with automatic temperature control gear.



Stacking steel strip on one of the four railcar furnace bases of the new bright annealing furnace at Bruntons wire mills

Subminiature Radio Compass

A NEW lightweight subminiature automatic direction finder for use in aircraft was seen in public for the first time at the Paris Air Show on 10th June. This radio compass, manufactured by Marconi's Wireless Telegraph Co., Ltd., and designed for use in the m.f. band, is believed to be the smallest and lightest of its type yet developed; the total weight of the main units is less than 10 kg. It has been developed for use in all types of aircraft, and is primarily intended for pilot operation.

The main units of the Marconi automatic direction finder

Contrary to conventional practice, the receiving aerial is fixed, being in the form of a sealed iron-cored crossed loop having no moving parts, and it has a maximum height of less than $\frac{3}{4}$in. A low drag loop installation can therefore be achieved without recourse to full suppression, or alternatively the aerial may be fully recessed into the fuselage if desired. Even in the latter case it is not necessary to cut a large hole in the fuselage.

A Bellini-Tosi type of direction finding system is employed, the goniometer being embodied in the bearing indicator. Bearing presentation is by means of a scale pointer, driven directly from the shaft of the goniometer search coil.

The receiver circuits are contained in two rack-mounted main units, and are remotely operated from a single control unit. Plug-in sub-units are used for ease of replacement. The frequency span is from 200 to 1,700 kc/s, covered in three ranges. A further valuable saving of space and weight is achieved by dispensing with the usual rotary transformer, as the 28 V d.c. aircraft supply is used directly for h.t. A portable test set which will check the main units and each of the plug-in sub-units has been designed specially for this equipment. This test set will greatly simplify servicing procedure.

OVERSEAS ELECTRICAL TRADE

Recovery in Exports in July

THERE was some recovery in the value of the electrical export trade of this country in July. The total was £13,151,403, against £9,818,805 in June but it has to be remembered that the June figure was depressed by the railway and dock strikes. Whether it was the continued influence of these stoppages which kept the July figure below that for the corresponding month of last year is not clear. The Board of Trade expected the effects of the strikes to be felt for some time afterwards.

While electrical exports for the first six months of this year were slightly higher than those in January-June, 1954, the seven-months' total is a little lower than that for the corresponding period of last year.

In the first seven months of the year the total value of electrical machinery exports was roughly maintained at the 1954 level although there were variations among the various items. For instance, while the exports of fractional h.p. motors increased there was a fall in those rated at 1 h.p. or more; the 250 h.p. and above class was almost halved in value. All classes of generators and generating

TABLE I.—ELECTRICAL EXPORTS

Class	July, 1955	Seven months ended 31st July, 1954	Seven months ended 31st July, 1955
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	68,406	725,876	782,426
Ditto, 10 to 65 kW	107,152	1,119,897	957,925
Ditto, 65 to 200 kW	101,887	609,188	690,930
Ditto, over 200 kW	190,561	2,424,233	2,798,701
Spark ignition engine driven	4,591	127,481	127,782
Steam turbine driven	32,222	591,583	878,544
Other prime mover driven	121,321	692,282	588,984
Generators	197,783	1,461,450	1,574,187
Parts of generators	220,938	2,670,234	2,850,331
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ⅛ h.p.	187,936	1,294,448	1,419,975
Over ⅛ but under 1 h.p.	67,480	351,548	432,847
1 h.p. to 250 h.p.	310,046	2,799,008	2,468,150
Over 250 h.p.	48,428	925,764	471,780
Railway, tramway and trolley-bus motors complete and parts of all motors	179,569	1,069,396	998,622
Motor starting and controlling gear	139,195	1,399,639	1,291,446
	1,977,515	18,262,027	18,332,630
Converting machinery	9,941	241,145	264,073
Mercury-arc rectifiers	64,010	369,980	438,011
Transformers for lighting, heating and power (incl. coils)	539,558	7,417,328	5,762,265
Switchgear and switchboards (not telegraph or telephone)	987,350	9,398,426	8,467,468
	1,600,859	17,426,879	14,931,817
Primary batteries:			
Lighting	50,376	470,557	466,101
Radio	159,575	1,032,431	1,167,136
Other	30,173	319,609	255,784
Parts (excl. carbons)	29,035	374,842	210,394
Lamps:			
Filament, exceeding 24 V	74,055	542,377	598,267
Ditto, under 24 V	24,715	207,927	208,922
Discharge lamps, fluorescent tubes, etc.	63,116	426,743	468,899
Other lamps	15,034	182,073	91,332
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilizing and cold cathode valves, magnetrons, klystrons*	6,377	—	143,144
Cathode-ray tubes	5,597	66,558	72,156
Other valves (not X-ray)†	152,106	1,151,593	1,196,763
Radio and television transmitters	22,085	431,667	404,999
Commercial radio and radar equipment	788,560	7,239,863	6,739,813
Domestic radio receivers, mains	141,688	1,158,955	1,105,699
Ditto, battery	46,908	384,959	444,565
Ditto, other (incl. car)	12,003	85,509	145,654
Radiograms	30,200	266,282	314,253
Television sets	30,715	145,923	84,488
Public address equipment	88,200	423,305	567,794
Sound reproducing app., n.e.s.	34,171	161,015	164,840
Components and parts, n.e.s., incl. parts of valves and c.r. tubes	683,025	4,013,860	4,165,290
	2,041,635	15,529,489	15,549,458
Telegraph and telephone installations	498,528	4,285,826	4,389,451
Telephone instruments, separately consigned	104,683	800,806	587,775
Telegraph and telephone parts	425,443	3,326,964	3,241,718
Line apparatus for long distance commun.	64,918	1,061,702	534,077
	1,093,572	9,475,298	8,753,021

Class	July, 1955	Seven months ended 31st July, 1954	Seven months ended 31st July, 1955
	£	£	£
Cookers	70,171	529,608	842,225
Toasters	28,092	130,803	220,633
Other cooking apparatus	26,932	226,600	200,298
Parts and accessories	61,516	296,446	461,440
Space heating appliances	27,754	245,067	268,147
Water heating appliances	26,282	181,898	204,266
Other heating appliances	18,964	247,427	190,838
Parts and accessories	96,560	325,710	492,002
Irons	85,449	435,450	719,508
Arc welding equipment, a.c.	36,559	248,434	221,446
Ditto, d.c.	29,815	332,318	199,588
Resistance welding equipment	12,174	121,098	129,136
Electric furnace plant*	53,639	—	276,313
Magnetos, ignition	14,267	107,712	109,690
Sparking plugs	139,820	1,032,135	1,056,822
Elec. appliances for aeroplanes, n.e.s.	164,463	1,371,298	1,301,669
Ditto, for motor vehicles, n.e.s.	315,075	1,668,490	2,101,881
Ditto, for cycles, n.e.s.	84,193	578,713	508,371
Signalling app. (incl. traffic signals)	33,106	371,304	315,304
Industrial radio-frequency equipment	10,788	147,830	97,639
Bell app. (not telegraphic or telephonic)	6,274	57,627	58,119
Instruments, commercial	143,411	1,064,642	968,139
House service meters (not prepayment)	79,720	837,046	667,015
Ditto, prepayment and parts of all house service meters	32,710	108,096	152,995
Electro-medical apparatus (not X-ray)	52,338	322,827	315,809
X-ray apparatus (excl. tubes and valves)	59,360	338,415	435,614
Vacuum tubes	9,469	135,278	148,506
Desk fans	15,063	237,128	150,445
Ceiling fans	41,403	701,174	564,529
Parts of fans*	3,607	—	40,634
Vacuum cleaners	169,154	1,286,094	961,380
Floor polishers	111,786	790,061	625,933
Food mixers	49,033	343,328	326,416
Hair clippers and dry shavers	39,027	554,313	500,448
Other portable appliances	24,940	189,131	305,891
Parts	86,860	524,449	526,366
Portable elec. tools (not saws) and parts	192,457	1,108,632	1,276,670
Cables and wires:			
Telegraph and telephone, submarine	7,050	542,352	489,993
Ditto, other	431,707	2,509,658	3,346,801
Cotton, silk or art. silk insulated	51,131	282,421	338,038
Enamel, glass or asbestos insulated	68,584	488,164	502,034
Paper insulated	776,972	3,963,724	4,289,429
Rubber insulated	386,584	2,857,455	3,209,075
Thermoplastic insulated	97,760	—	513,354
Other	159,719	1,715,259	1,264,431
	1,979,507	12,359,033	13,953,155
Accumulators for motor vehicles	118,289	1,105,524	969,515
Ditto, traction	16,472	167,936	107,333
Ditto, radio and other portable	47,409	246,989	405,571
Ditto, other	32,881	405,366	172,089
Parts and accessories	123,315	435,669	620,410
Elec. porcelain, etc. (incl. insulators)	83,691	634,981	613,663
Insulating cloth and tape	46,030	350,317	404,320
Other insulating material	92,638	521,802	634,466
Permanent magnets	47,267	287,403	323,505
Radio, telegraph and telephone testing equipment, n.e.s.	41,634	222,763	297,739
Scientific elec. instruments (not telegraphic or telephonic)	177,695	1,439,979	1,615,221
Electrical machinery, n.e.s.	104,174	842,010	695,566
Electrical apparatus and appliances, n.e.s.	626,510	3,842,555	3,978,912
TOTAL	13,151,403	104,311,161	103,758,351

* Not separately distinguished before 1955. † The 1954 and 1955 figures are not completely comparable.

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	July, 1955	Seven months ended 31st July, 1954	Seven months ended 31st July, 1955
	£	£	£
Channel Islands	76,267	383,696	375,045
Gibraltar	7,755	60,071	134,113
Malta and Gozo	25,730	330,322	312,298
Cyprus	61,421	460,208	628,652
Sierra Leone	7,762	208,541	158,058
Gold Coast	144,131	722,766	899,875
Nigeria	233,548	1,072,640	1,676,357
Union of South Africa	973,595	11,325,282	10,169,793
Rhodesia and Nyasaland	344,558	2,300,639	2,617,289
Tanganyika	73,737	417,040	525,784
Kenya	88,502	1,047,953	980,768
Uganda	58,382	457,298	557,480
Mauritius	15,093	167,516	199,705
Aden	27,747	664,149	299,111
Bahrain, Qatar and Trucial Oman	36,541	870,843	510,815
Kuwait	54,040	955,841	585,356
India	832,219	9,201,171	8,307,427
Pakistan	285,805	3,462,665	2,275,180
Singapore	187,210	1,864,553	2,082,848
Federation of Malaya	188,374	1,571,794	1,540,744
Ceylon	88,661	884,990	734,527
British North Borneo	19,403	243,937	152,087
Hong Kong	138,359	1,168,582	1,009,578
Australia	1,704,737	10,671,329	11,441,374
New Zealand	697,858	5,694,955	7,007,914
Canada	801,343	4,151,830	4,072,273
Jamaica	78,165	468,172	550,884
Barbados	23,142	144,466	120,895
Trinidad	132,396	578,560	610,678
British Guiana	51,682	259,197	332,198
Anglo-Egyptian Sudan	19,332	721,029	534,363
Other Commonwealth countries	71,514	842,284	956,294
Irish Republic	348,651	1,951,662	2,245,118
Soviet Union	225,085	1,507,098	1,346,377
Finland	110,335	810,542	711,658
Sweden	415,423	2,583,821	2,379,137
Norway	412,724	1,790,833	2,250,841
Iceland	7,204	98,404	69,368
Denmark	163,067	1,250,342	1,031,002
Poland	9,733	513,745	144,669
Western Germany	170,267	839,428	1,078,799
Netherlands	548,240	3,946,695	3,777,337
Belgium	343,457	1,886,516	1,689,335
France	272,693	2,070,273	1,844,066
Switzerland	116,191	678,582	599,768
Portugal	177,535	1,547,287	1,562,674
Spain	123,809	1,564,090	975,919
Italy	317,565	1,704,487	1,601,548
Austria	71,068	476,373	339,363
Yugoslavia	31,936	757,457	398,580
Greece	82,230	473,423	660,006
Roumania	27	1,665	970
Turkey	81,914	355,113	648,920
Belgian Congo	4,859	197,657	180,966
French Morocco	33,393	179,268	209,646
Portuguese East Africa	11,011	165,552	121,507
Syria	16,187	187,823	193,068
Lebanon	18,793	249,651	214,182
Israel	20,034	250,511	231,945
Jordan	17,630	150,387	187,436
Egypt	143,175	671,350	931,732
Libya	13,105	63,586	102,097
Saudi Arabia	29,168	396,127	485,702
Iraq	37,263	1,637,250	1,343,189
Iran	15,643	229,578	398,172
Burma	51,259	875,012	998,341
Thailand	37,705	1,192,303	882,155
Indonesia	52,746	302,339	197,365
Japan	16,414	266,952	550,547
United States of America	469,436	1,813,443	2,690,488
Cuba	22,205	145,165	153,360
Mexico	43,230	188,016	218,677
Colombia	84,223	534,533	559,145
Venezuela	98,763	1,107,290	1,586,161
Peru	22,216	237,589	207,823
Chile	6,053	201,759	193,737
Brazil	28,199	585,991	261,138
Uruguay	35,591	550,279	264,526
Argentine Republic	122,756	603,936	1,066,939
Other foreign countries	122,183	1,145,659	1,613,089
TOTAL	13,151,403	104,311,161	103,758,351

sets showed an improvement, with the exception of diesel sets between 10 and 65 kW and those driven by unspecified prime movers.

There was a decline in the exports of "converting machinery; mercury-arc rectifiers; transformers; switchgear and switchboards" from £17,426,879 to £14,931,817, largely because of a fall in the value of exported transformers and switchgear. It is satisfactory to see a rise in cable exports, from £12,359,033 to £13,953,155, although this was counterbalanced by lower exports of telegraph and telephone equipment.

One feature of the domestic electrical exports was a rise in cooker shipments from £529,608 to £842,225; the value of toaster exports also moved upward. Lower values were recorded for vacuum cleaners, floor polishers, food mixers and hair clippers.

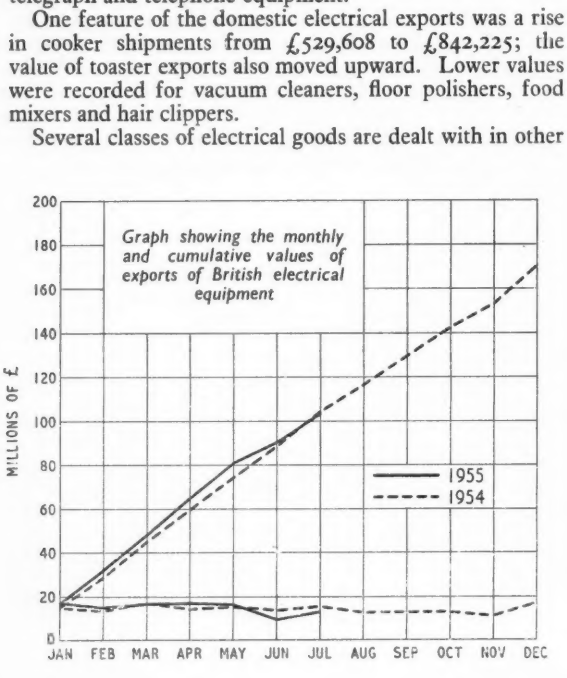
Several classes of electrical goods are dealt with in other sections of the Board of Trade returns. Among them are the following, with the July figures and (in parentheses) those for the first seven months of the year:—Electrically-operated washing machines, not exceeding 150 lb weight, £251,628 (£1,868,686); ditto 150-250 lb, £93,481 (£783,434); parts of electrically-operated washing machines, £40,257 (£372,484); electric locomotives, £303,139 (£1,353,744); i.c. engine locomotives with electrical transmission, £843,010 (£3,068,519).

Last month Australia was the only customer to exceed the million-pound mark; in July last year there were two others—South Africa and India—whose shares last month were £973,595 and £832,219 respectively. Canada took fourth place with £801,343 but this compared with £822,763 in July last year. Noteworthy among the increases were Norway (£412,724, against £338,051), Belgium (£343,457, against £276,479), France (£272,693, against £189,287) and, particularly, the United States (£469,436, against £244,934).

The United States is also a bright spot in the seven-month totals with a figure of £2,690,488 as compared with £1,813,443 in January-July, 1954. Australia assumed the lead from South Africa in the seven-month figures, although her share of £11,441,374 was over £800,000 down in comparison with the corresponding period of last year.

In Latin America rises in Argentina's share from £603,936 to £1,066,939, and in those of Venezuela and Mexico, were somewhat offset by declines in the values attributed to Chile, Brazil and Uruguay.

There was a substantial rise in electrical imports in July—from £1,647,580 to £2,241,867; this raised the total for the first seven months of the year from £9,625,627 to £12,953,866. The rise in the last figure was due to greater purchases from abroad (mainly the Netherlands, Western Germany and the United States) of telecommunications equipment. There were actually decreases in imports of generators (£302,276, against £643,441) and cathode-ray tubes (£701,853, against £1,130,003).



National Radio Show

Radio and Television Progress

Manufacturers' Latest Equipment

By E. A. W. SPREADBURY, M.Brit.I.R.E.

AT the time of going to press the uncertainty over whether or not the 22nd National Radio Exhibition would be proceeded with had only just been resolved. A dispute between the organizers, the Radio Industry Council, and members of the Electrical Trades Union held up the preparation of the stands and the opening had to be postponed from Wednesday until to-day (Friday). The dispute and its settlement are referred to at greater length on page 396 of this issue.

It has been possible to obtain from the manufacturers particulars of their latest equipment being shown at Earls Court and we deal with this in the following pages.

To-day there are two themes of major interest, both of which are of national importance. One is the new system of transmission for radio programmes at very high frequencies in Band II, which officially commenced operating in May this year, and the other is the alternative television programmes to be transmitted by the Independent Television Authority in Band III, which are scheduled to commence on 22nd September.

To put over to the public the story of V.H.F. radio, the B.B.C. has arranged a special demonstration theatre capable of holding about 100 people. Special recordings are showing the advantages that the system possesses in the face of various kinds of interference. The television signal being fed to the stands contains two alternative sound and vision programmes at carrier frequency, one on channel 4, and one on channel 8 (in Band III). All tunable TV receivers therefore can receive a "live" alternative programme.

The plans this year include all the traditional features that we have come to expect, such as "Television Avenue" permitting a side-by-side comparison of many different receivers and a very large B.B.C. studio to seat an audience of 650 people and a huge arena for "outside" television broadcasts, seating 850 people. In addition to this, a R.I.C. studio and control room are projected.

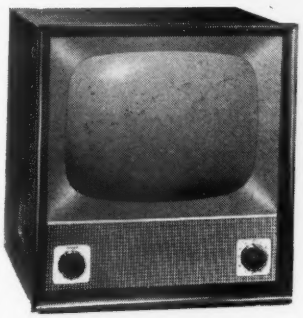
It is probably true to say that this year the manufacturers have more to offer in technical development than for some years.

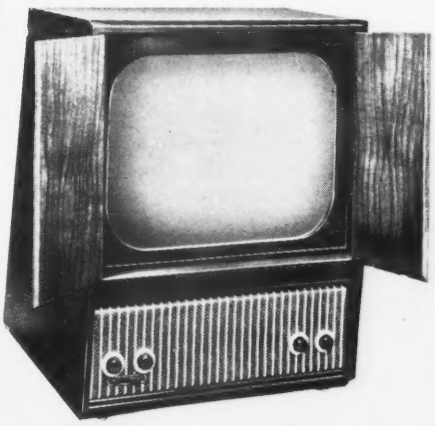
The new V.H.F. sound services, which use the frequency modulation system of transmission (F.M.) promise to set a new standard of listening in many parts of the country where reception by the present amplitude modulation system (A.M.) is unreliable or worse owing to fading or to interference from foreign stations or from many forms of electrical interference. The transmissions are in a very high frequency (V.H.F.) region quite new to sound radio, and they use a system of frequency modulation (F.M.) that is also quite new. These V.H.F. radio transmissions are radiated on frequencies between 87·5 Mc/s and 95 Mc/s in Band II, which is roughly twice the frequency of a Band I television signal and is approximately equal to a 3-metre in wavelength.

More than a third of the radio receivers and radiograms which are being exhibited can receive these F.M. transmissions, and most of them are designed to receive the normal A.M. transmissions on the medium wave (M.W.) and long wave (L.W.) bands as well, while some of them also receive the short-wave A.M. transmissions. Such receivers are described as A.M./F.M. receivers. There are a few complete receivers which will receive the F.M. transmissions only, and there are also *incomplete* receivers which will receive the F.M. transmissions but are not equipped with an output valve and loudspeaker to reproduce them. The last are called F.M. feeder units, and their purpose is to feed the demodulated output at low level from an F.M. transmission to an audio amplifier,

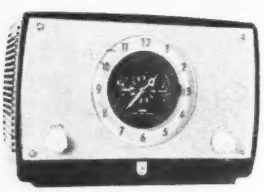
Left: Representative of the large directly-viewed a.c. or d.c. table television receiver, this Ferguson 206T has a 17in tube and a turret tuner

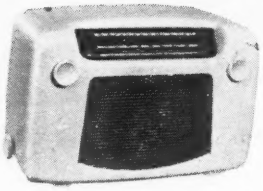
Below: The Cossor 937 has a turret tuner and 17in tube in a table cabinet



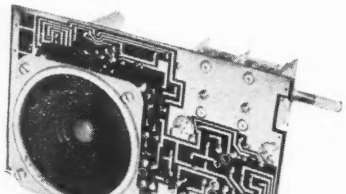


Above: The Ferranti 20T5 is exceptional in that it contains a projection receiver (20 inches diagonal) in a table cabinet. Right: Typical of the tendency to use increasingly arger c.r. tubes is that in the Ekco TC220 which measures 21 inches diagonally. This set receives alternative TV programmes and the radio services





The Philips "Music Maid" has four pre-set station tuning and a time switch. Right: An inexpensive A.M./F.M. receiver — the K.-B. MR10



This experimental printed circuit (Telegraph Condenser Co.) is a working 4-valve battery portable receiver

which might be a very high quality amplifier or the pick-up sockets of an ordinary receiver.

A type of receiver that bids fair to become the standard model of the future is a three-band A.M./F.M. receiver with L.W., M.W. and V.H.F. bands, the last replacing the S.W. band that has commonly been included in the past. It has six valves including the rectifier and has internal aerials of a new kind from which it can work satisfactorily anywhere within the primary service area of the transmitter, a radius of something between 10 and 20 miles. For F.M. there is a horizontal compressed dipole running round the inside of the cabinet. Such a receiver is a good proposition even now, when only one F.M. transmitter (radiating the three programmes—Home, Light and Third) is actually working, because by the end of next year it is planned to cover 84 per cent of the United Kingdom with V.H.F. with a reliable signal, and in the meantime the receiver will continue to work on the A.M. bands. Such receivers cost £21 upwards and no battery-operated models are yet made.

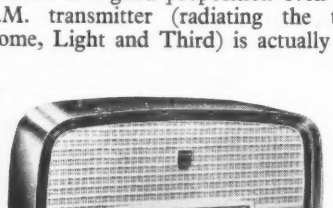
Inspired no doubt by the novelty of the new system, some manufacturers have adopted new cabinet styles to house these receivers, giving them added freshness. Two styles that seem to have associated themselves with F.M. table models are a tall cabinet of shallow depth, with inclined front panels that are recessed where they meet half-way up the face of the receiver, which has a distinctive elegance and the "picture frame" cabinet, whose horizontal front elevation is framed with a heavy beading.

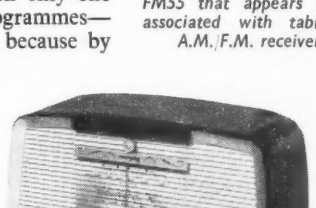
The declared purpose of the B.B.C. in selecting F.M. for the new services was to combat interference, but an incidental advantage is the much higher musical frequency range that can be resolved with it than with A.M. in the M.W. band. The audio frequency range is theoretically unlimited, and although the highest frequency that can be resolved is limited to that transmitted by the B.B.C., on the average that might be an octave higher than can be resolved with an A.M. receiver on M.W., but it exceeds that on the best transmissions.

The result of this is that so-called "Hi-fi" enthusiasts who possess really high quality audio amplifying equipment are taking a keen interest in F.M. feeder units. Interest in such equipment has been growing steadily during the last two or three years, both in this country and in America.

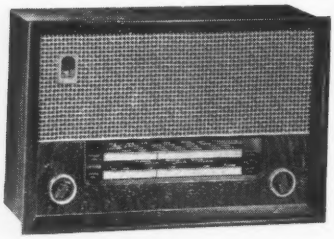
The growing popularity of high quality amplifiers has

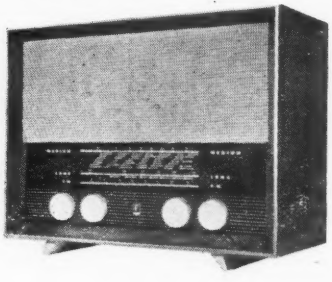
This McMichael television table trolley TT4 is mounted on rubber-type castors and contains a two-band A.M. radio receiver, and below, right: from the same manufacturers the tall shallow cabinet pattern of Model FM55 that appears to be associated with table-type A.M./F.M. receivers

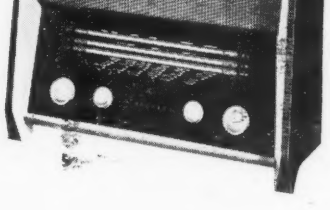




Contemporary design in a plastics table cabinet: the Ultra A.M./F.M. receiver. Right: An attractive low-priced A.M./F.M. receiver: the Murphy A362. A "picture frame" cabinet houses the Cossor 523 A.M./F.M. receiver, which has a ferrite rod A.M. aerial, a compressed dipole F.M. aerial, and covers S.W., M.W. and L.W. on A.M. Below, centre: A similar style of cabinet with straight staggered legs more common in console receivers, is employed in the Ferranti 255 A.M./F.M. model







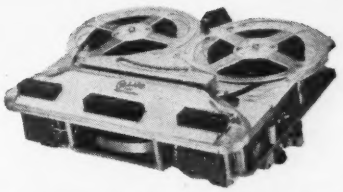
Left: The Masteradio "Mastergram" is representative of the 3-speed automatic table radiogram. Right: This Marconiphone auto-radiogram combines an A.M./F.M. radio receiver with a three-speed auto-changer record player

led a number of manufacturers to cater for the enthusiast, and it has permitted the cost of this relatively expensive equipment to be reduced drastically, in some cases by more than half. For those who prefer to construct their own equipment, there are amplifier kits of very great merit.

Commercially constructed amplifying equipments are also available, and in two cases at least "stereophonic" reproduction can be heard. One of these is by the G.E.C., who use multi-track tape records driving professional amplifying equipment which feeds suitably placed speakers and gives a very convincing impression of reality. The other is the H.M.V. "Stereosonic" tape reproducing equipment. This comprises two large cabinet units which are situated in adjacent corners of a room, each reproducing one of the twin tracks of a stereophonically recorded magnetic tape, again giving very realistic reproduction with "three dimensional" qualities. The outstanding point about the H.M.V. equipment, apart from its quality, is that it is marketed as a domestic reproducer, and is the first of its kind. Special tape records are made for it.

Alternative television programmes in Band III constitute a new departure in this country, which has in the past regarded television as a single-programme service. The popularity of television has always gone forward by leaps and bounds under the stimulus of important national events, such as royal ceremonial occasions and big sporting spectacles, but it is doubtful whether any single event has had such a powerful effect as has the prospect of alternative, and moreover commercial, programmes.

Although it may be a matter of years yet before some parts of the country can receive the alternative programme, there are only two models designated for the Show that are not equipped with a Band III tuner, and they are provided with a plug-and-socket device to accept one. Most manufacturers have adopted the 12-position turret-type tuner as the "front end" unit on their receivers although some use a 12-position or 14-position incremental (tapped) inductance tuner, and others employ a 3-position unit that can embrace any Band I and any two Band III stations. (The B.B.C. proposes to introduce its own alternative programme in Band III in due course.)



Top: The Reflectograph portable tape recorder RR100 has a mains-operated recording amplifier, but uses a fully transistorized play-back amplifier. Below: The Collaro tape "Transcriptor" has a large-diameter flywheel, four heads for the two tracks, and duplicate press-button controls

For the owner of an existing receiver operating only on Band I there are numerous adaptors and convertors, otherwise known as tuner units, to adapt them to Band III. Most set makers have produced special units to suit their own more recent receivers, and these are fitted inside the cabinet as a rule, although that depends on the circumstances. Some of these replace the existing "front end" section of the receiver entirely and may even incorporate a 12-channel control, while others replace it only while receiving on Band III.

A number of manufacturers, generally not set makers, market a third type which can be used with any make of receiver and is inserted electrically in series with the aerial lead to the receiver. This involves a method known as the "Double Superhet" principle (a misnomer if the

This G.E.C. A.M./F.M. auto-radiogram, BC9640, has a "contemporary" cabinet but there is an alternative for those who prefer the "traditional" style

receiver has a T.R.F. circuit) in which the Band III signal is frequency-changed to the local Band I channel frequency before it reaches the receiver. Thus there are convertors for all types of TV receivers, although it must be admitted that there are certain limited circumstances in which they may not be entirely satisfactory, especially in very old receivers. They cost about 5 or 6 guineas.

One of the advantages of the turret tuner lies in its flexibility, because it is a simple matter to insert tuning inserts in any position of the turret for any frequency in Bands I, II or III. Most turret sets to-day are equipped with inserts for all five Band I channels and two Band III channels, but a few firms have ingeniously added three inserts for Band II (V.H.F. radio) and arranged for change-over switching in the receiver to convert the sound channel to an F.M. receiver. By this means they achieve a complete TV/radio combination covering all programmes likely to be available in this country in the foreseeable future. They cost about 5 or 6 guineas.

One of the most remarkable features of television receiver development is the public demand for increasingly larger cathode-ray tubes. Only three or four years ago the 12in tube was regarded as reasonably large, and it was accepted by many as being a good optimum size. Now the most common size is a rectangular tube with a 17in diagonal. Among some 150 television receivers on show, about half are 17in and 30 per cent are 14in. A new tube size of 21in (diagonal) which made a brief appearance last year, is incorporated in 12 per cent of the new models, while some 8 per cent use projection. Three receivers with 12in tubes are shown.

These very large tube sizes have been made possible only as the result of ingenious manufacturing processes developed by the tube makers, who have increased the maximum permissible beam deflection angle from about 50 deg in early tubes to 90 deg in the latest, thus achieving a valuable reduction in overall length. Despite this achievement, such tubes are very bulky and expensive, and one would expect that projection should provide the ultimate solution to large picture sizes. That it does not provide a complete solution is evident from the proportions of the two types being exhibited. Only four firms are showing them, but it is significant that they specialize in them and produce bright clear pictures. The largest is 6ft by 4·5ft.

The variety of types of television aerials continues to grow. To the numerous kinds of aerials for Band I, which are tending to settle down in design features, there are added many types for Band III, together with a range of combined Band I/Band III designs and an intriguing variety of devices designed to add the combined facility to existing Band I installations. For the combined TV/F.M. receiver just referred to there is a special TV/F.M. aerial.

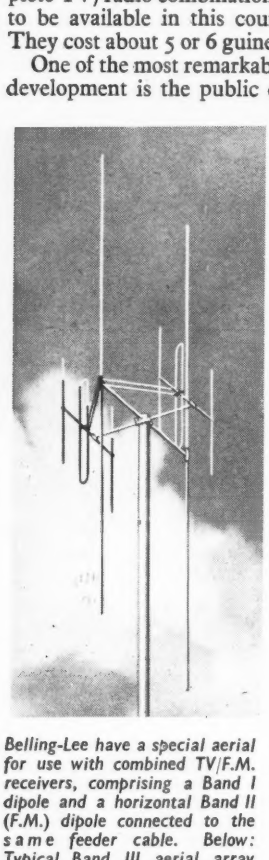
Conventional combination TV and radio receivers using an A.M. radio unit show a decline, but one of those shown comprises two entirely separate radio and TV receivers, even to the extent of their speakers. Two of them consist of an A.M./F.M. radio chassis combined with a TV chassis, affording a second method of combining TV and F.M. radio.

Far from being eclipsed by the growth of television, sound radio has fully maintained its popularity, and radio-gramophones continue to exert an increasing pull, while all-dry battery and mains/battery portables are steady favourites. One feature that has improved the performance of all kinds of A.M. receivers is the ferrite rod aerial, which measures only about 9 by 1in and has so increased their sensitivity that where an indoor aerial has been sufficient in the past, no aerial is necessary at all.

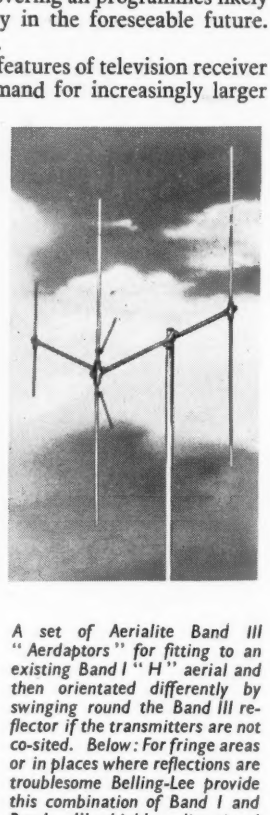
The advent of F.M. has undoubtedly given a fillip to sound broadcasting, and most A.M./F.M. receivers are equipped with a ferrite rod aerial for A.M. and an internal compressed dipole for F.M. so that they need no external aerial for either service within the primary service area of a transmitter. With a ferrite rod aerial, a sensitive pocket-size portable becomes an accomplished fact.

All radiograms (and record players) now have 3-speed motors as a matter of course, and the majority of them have record-changing facilities, while one or two have a tape recorder as well, or provision for one to be fitted. The portable tape recorder itself as a separate item has gained considerable popularity in domestic entertainment and is used for amateur theatrical rehearsals and for correspondence. Their prices range from 35 guineas to well over £100. A pocket-size wire recorder is made specially for commentaries and interviews.

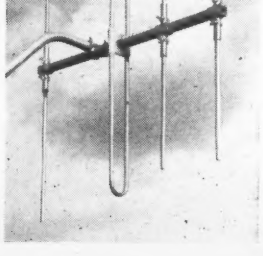
Transistors and printed circuits are making considerable progress in some branches of electronics, but so far their effect on the radio industry is small, although both are used extensively in hearing aids.

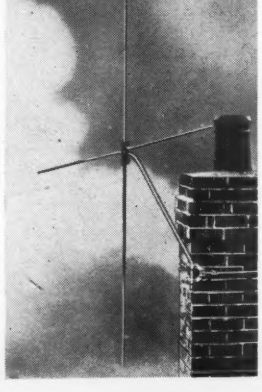


Belling-Lee have a special aerial for use with combined TV/F.M. receivers, comprising a Band I dipole and a horizontal Band II (F.M.) dipole connected to the same feeder cable. Below: Typical Band III aerial array (Wolsey) of four elements which can be combined with an existing Band I aerial feeder by means of a cross-over unit



A set of Aerialite Band III "Aerdaptors" for fitting to an existing Band I "H" aerial and then orientated differently by swinging round the Band III reflector if the transmitters are not co-sited. Below: For fringe areas or in places where reflections are troublesome Belling-Lee provide this combination of Band I and Band III highly directional stacked broadside arrays





Atomic Energy Conference

Final Proceedings at Geneva

IN the earlier stages of the International Conference on the Peaceful Uses of Atomic Energy, already reported in the *Electrical Review*, attention was mainly focused on the use of nuclear energy to supplement or replace conventional fuels in the production of electricity. Parallel and later sessions were devoted to details of the enormous amount of highly specialized technological work being undertaken with the aim of reducing capital costs and securing neutron economy, together with safety from fission products, in the power field and also in the production of isotopes for medical, industrial and agricultural purposes.

Numerous types of reactor, varying chiefly in regard to the means of moderating neutron speeds and methods of cooling reactor cores to provide steam, formed the subjects of many papers. The majority of these contributions concerned experimental work in the U.S.A., where the amplitude of present resources of ordinary fuels, as compared with that in Great Britain, permits of considerable latitude as regards the time factor in bringing them into commercial operation.

Notable among these papers was an account (Siegel and others) of research in the use of liquid sodium (at 450 to 900 deg C) as the heat transfer medium from a graphite moderator. Sodium was held (by Troski and others) to be more satisfactory in many ways as a coolant than sodium-potassium alloy, which was, however, said to be easier to use within a piping system, primarily because of its lower melting point. A design was described of a graphite-moderated unit cooled by water at 1,840 lb/sq in and 485 deg F at heat exchanger exit (Anderson and others) which is expected to cost $65 million and to produce 220 MW at 0·6d/kWh. Light water at 2,000 lb/sq in serves both as coolant and moderator for the 60 MW Shippingport power scheme sponsored by the U.S. Atomic Energy Commission. Electro-magnetic pumps were treated in some detail by S. G. Bauer (Rolls-Royce, U.K.), as the most important method of moving liquid metals (particularly alkali metals), which had many advantages for transferring heat. For an aqueous homogeneous reactor expected to be in commission in a 100 MW U.S. power station within the next four years, R. B. Briggs and J. A. Swartout estimated capital expenditure at about £75/kW, excluding fissile material, compared with £50 for a coal-fired station. Processing thorium 233 should add less than 0·09d/kWh.

Importance of Isotopes

A long-dated inquiry (by Linder and others) into the possibility of direct conversion of nuclear radiation (from reactor by-product radioactive isotopes) to electrical energy revealed that this source under any known conditions could be considered only for microwatt applications. The importance of these isotopes for many more immediate uses was discussed by Aebersold, who referred to their major applications in industry as thickness and density gauging, analysis by radiation penetration, liquid level gauging, sorting and packaging, and luminescence in phosphor materials. Saving of time and of materials in research were further merits as were increases in agricultural productivity and improvement in storage of foods. Similar conclusions were reached in another U.S. paper (Eaton).

Mr. Dag Hammarskjold, the secretary-general of the United Nations Organization, took a keen interest in the Conference. He is seen here with Mr. James Cameron of the Atomic Power Department, English Electric Co., Ltd.

Developments in thickness gauges and allied instruments provided a theme for J. L. Putnam (Harwell, U.K.), who stated that several commercial beta-particle transmission gauges were now available, mainly operated with ionization chambers, for measuring " basis weight " from 1 to 1,200 mg/cm². Associated electrometers included d.c. valve and vibrating reed types. Gamma-ray gauges were used for greater thicknesses for which low-gain scintillators provided alternatives to ionization chambers; 170 Tm was now a low-energy source. Both rays were used as density gauges. A beta gauge was in use for operating a servo-mechanism. Commercial models of level gauges and package models could be supplied.

New designs of beta-particle back-scattering gauges permitted the inspection of areas no greater than $\frac{3}{8}$in in diameter; one of these employed a scintillating counter as detector. A gamma-ray gauge was in production which selected back-scattering radiations by virtue of their reduced energy and rejected direct radiations from the source to the detector; this eliminated heavy screening, enabled small sources to be used and facilitated detection of small flaws, such as internal pitted corrosion in metal tubes. A portable neutron monitor for rapid measurement of water and hydrogen content of soils operated entirely on the surface and gave reliable and reproducible indications of total hydrogen content to a depth of 9in in sand, humus and sawdust having water contents from zero to 40 per cent. Analysis of prompt gamma rays arising from the capture of neutrons gave information about the capturing medium. A portable device was under development for oil well control and other applications. Other developments of radioisotopes for use in industry were described by H. Seligman.

Apart from those papers which were referred to last week, most of the British contributions on reactors dealt with painstaking but apparently rewarding investigations at Harwell into subsidiary aspects that have been essential to construction at the present stage or fundamental to future progress. Of basic interest was a contribution by E. Bretscher, J. V. Dunworth, H. J. Grout and J. F. Loutit, which examined the features desirable in research reactors, according to their intended use, which indicated the means adopted to meet the flux and space requirements.

The experimental facilities of the heavy-water reactor, E443, mentioned last week as a prominent item among the national exhibits, were described by H. J. Grout and F. W. Fenning. A principal duty of this reactor was to make available thermal neutron fluxes up to 10^{14}n/cm^2/sec for radioisotopes of higher specific activity than those dealt with by existing plant at Harwell, which can provide up to $1{\cdot}5 \times 10^{12}$n.

Fuel cycles and types of reactors were dealt with by J. V. Dunworth. Developments in neutron spectrometers based on pulsed sources were discussed by E. R. Wiblin, who showed that a 15 MeV accelerator giving a hundred-fold increase in source strength over the initially used 3·2 MeV accelerator made possible quantitative evaluation of resonance constants up to neutron energies of 550 eV and of descriptive work up to energies of 40 eV.

P. W. Mummery reported that while the relative importance of various data used in lattice calculations differed according to the moderator used, the thermal and fast fission factors and the resonance integral for U238 were the most important.

Changes in the electrical properties of graphite due to fast neutron irradiation at different temperatures were demonstrated by G. H. Kinchin. The thermal expansion coefficient of graphite, he stated, changed little owing to irradiation, but there were large changes in the elastic moduli which were not easy to account for. Neutron resonance absorption of U238 was the theme of another paper by V. S. Crocker.

Causes of Uranium Damage

Damage to uranium during burn-up was stated by S. F. Pugh to result from change of shape, wrinkling of surface, volume expansion, and also from changes in mechanical strength and lattice structure. Embrittlement during irradiation had not so far presented a serious problem, though the steep temperature gradient might cause cracking as a consequence. A method used for calculating the critical size of a spherical homogeneous intermediate-energy reactor with the aid of an automatic digital computing machine was described by Mrs. M. E. Mandl and J. Howlett.

Measurements made by D. J. Litler with the GLEEP pile oscillator of changes in effective cross-section of uranium irradiated in the BEPO, Windscale and NRX reactors, supplemented by similar measurements for individual fissile isotopes and poisons with neutron spectra, would enable reactivity changes in natural uranium power producing piles to be predicted.

As a result of a study of processes for the separation of fissile and fertile materials and fission products, C. M. Nicholls concluded that, for nuclear power stations and experimental reactors, the plant could most economically be centralized instead of being situated near the reactors as was the practice with reactors used solely for the production of fissile material.

A technique to determine the chemical condition of fission products in enriched uranium which had undergone 0·4 per cent burn-up was presented by G. N. Walton, B. Bowles and I. F. Croall. Their investigation showed fission-product iodine to behave differently from molecular iodine.

Low-energy cross sections of fissile materials were subjects of papers by J. F. Raffle and B. T. Price and by J. E. Lynn and N. J. Pattenden. Notes on neutron yields from fissile nuclei by P. A. Egelstaff and J. E. Sanders and plutonium-water critical assemblies by C. C. Horton and J. D. McCullen were also presented in the physics sessions together with calculations of the structure of thermal neutron flux by J. H. Tait.

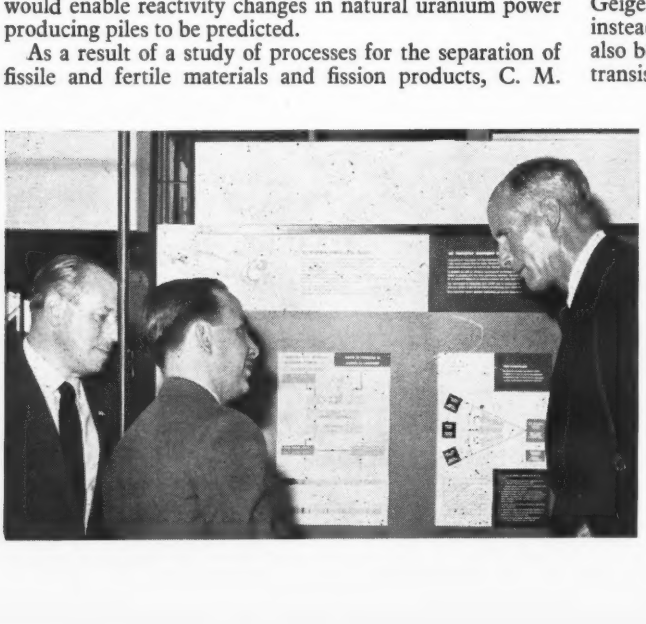
Chemistry and Metallurgy

In the chemistry and metallurgy sessions were included accounts of the effect of radiation on heterogeneous systems of air or nitrogen and water by J. Wright and of its damage to non-fissile materials by J. A. O. Varley. Design and operating experience with an atomic energy radiochemical laboratory were dealt with by R. Spence, the chemistry of fission-product ruthenium by J. M. Fletcher and F. S. Martin and electronic configuration of the actinide elements by J. K. Dawson and G. R. Hull. Other papers under the same broad heading concerned the production of uranium metals (L. Grainger) and an account of infra-red methods for the analysis of heavy water (J. Gaunt).

The same section also covered prospecting for nuclear materials. C. F. Davidson emphasized the necessity for fundamental geological knowledge of what kind of country was potentially hospitable to radioactive minerals. Of the instrumental aids to this prerequisite the most useful was a portable ratemeter of the Geiger-Muller or scintillometer type. Aerial surveys at 50 to 100ft up with scintillometers could give useful results. The likelihood of finding important new uranium and thorium deposits in Britain seemed remote.

It was stated in a paper by H. Bisby, E. Franklin and D. Taylor that British designs of prospecting instruments had been based on a halogen-quenched robust type of Geiger counter often associated with cold-cathode valves instead of conventional hot-filament valves. There had also been recent developments in scintillation counters and transistor equipments. The authors described an automatic uranium analyser developed in collaboration with L. Taverner in connection with the ion-exchange method of uranium extraction.

Safety aspects and control of radiation hazards were discussed at several sessions. Administrative and legal problems and codes in Britain were discussed by W. Binks. "The Experimental Animal for Study of the Biological Effects of Radiation" was the title given to his paper by J. F. Loutit. In unfavourable circumstances, W. G. Marley and G. M. Try estimated, a release of fission products equivalent to 0·1 MW of reactor power might necessitate lengthy evacuation of civil



Sir Christopher Hinton in discussion with Mr. Alan Ross of the G.E.C. Research Laboratories on the G.E.C. stand at Geneva. On the left is Mr. John Nilson (Export Department)

populations within 1·7 km and restrictions on others up to 5·7 km, whilst milk might be seriously contaminated from pastures up to 20 km. Under the very worst conditions of rain the distances might be 2·8 times as much. There was, however, a wide discrepancy between seemingly possible disasters and the accident record of the atomic energy industry. Disastrous consequences could be predicted if large quantities of chlorine or phosgene escaped in liquid gas production, but such gases, equivalent in toxicity to the contents of a nuclear reactor, were transported by rail in many countries. A few large-scale releases of such gases had occurred but these had not resulted in the remote siting of the plants. It was concluded that the satisfactory siting of suitably enclosed high-power reactors presented no insurmountable problem.

In a second paper by W. G. Marley, with B. S. Smith as his collaborator, experience of six years' safe operation of a 6 MW experimental reactor at Harwell confirmed the contention that by following a few simple rules safety of operating staff could be assured.

Comparison of the natural levels of radiation before the commencement of radioactive work in the Sellafield factory (Cumberland) of the Atomic Energy Authority, with subsequent surveys, showed that the operations had not caused any radioactive hazards. The survey, D. R. R. Fair and A. S. McLean stated, was made from 250 points within a radius of 25 miles from the factory and was divided into three main parts: naturally occurring gamma radiation; alpha and beta activity of soils, roots and vegetation; similar activity in the air.

What a medical man required to know in regard to liability of persons to injury by ionizing radiation and their treatment in the event of such injury was set out by E. Rock Carling. These requirements included advice on prevention and diagnosis of disorders at an early stage. To this end the medical man must know something of the characteristics of the noxious agent and its symptoms, be acquainted with any available therapeutic agents and records of death and survival. Since there was no specific remedy for radiation damage, treatment of results did not differ from that of medical practice in general.

In some respects waste disposal could be considered under the same general heading of safety. Disposal in the sea formed the subject of a composite paper by H. Seligman, H. J. Dunster and D. R. R. Fair with A. S. McLean. Long-term aspects were dealt with by E. Glueckauf, who, in conjunction with T. V. Healy, also submitted a paper on the chemical processing of fission product solutions. Of more than 450 papers included in the Conference programme (nearly 70 having British authors), close on 100 (15 British) were specialist studies of medical and biological aspects.

Sir John Cockcroft Sums Up

As we mentioned last week, the final evening lecture at the Conference was given by Sir John Cockcroft. It was in the nature of a summing-up of the proceedings. Sir John said that eventually nuclear energy would become the world's principal source of power. In five years' time there would be in operation at least ten atomic power stations of up to 200 MW in various parts of the world. The next decade would see a sound basis laid for nuclear power development and in the second decade the cost of this power would probably fall below that of power produced from coal or oil.

After saying that ample supplies of uranium and thorium seemed to be assured, Sir John said that nuclear power development had come only just in time for Great Britain; it was believed that by 1975 about half of this country's power needs would be met by nuclear energy. Ultimately the problem of deriving power by fusion reactions in light elements would be solved, to give an inexhaustible source of energy.

Finally, Sir John urged the need for the continued study of the effects of radiation on human beings and the importance of international co-operation to promote the peaceful uses of atomic energy and prevent its use for warlike purposes. He made reference to the European Atomic Energy Society of which he has been re-elected president.

Visits have been paid to the Atomic Energy Establishment at Harwell by about 150 delegates to the Conference, including representatives of Russia, Czechoslovakia, Poland, the United States and Canada.

Sir John Cockcroft has accepted an invitation for him and four of his colleagues to inspect Russian atomic activities in the near future.

President's Concluding Address

The achievements of the Conference were summed up in a final address by the President (Dr. H. J. Bhabha) on Saturday last. He said that important political consequences would arise from this scientific conference. Once released, knowledge could not be withdrawn and at the Conference the participating nations had taken an irreversible step towards closer collaboration.

Mr. Dag Hammarskjold, the secretary-general of U.N.O., had told him that he (Mr. Hammarskjold) intended to put forward proposals to the United Nations which would follow up the work of the Conference in order to equip the U.N. Organization to meet its responsibilities in the atomic field. There was, said Dr. Bhabha, a unanimous desire that a further conference should be held after an appropriate period had elapsed.

Electrical Industries Golf Championship

The National Final of the Electrical Industries Golf Championship will be held at Sutton Coldfield and Little Aston Golf Courses on 26th September. At Sutton Coldfield the final of the 18-holes medal round for the Sir Montague Hughman trophy, the runner-up prize presented by Mr. J. L. Welson, and the best scratch score prize presented by the late Mr. J. Y. Fletcher, will be played. This event is for the winners, runners-up and the best scratch scores in the Area finals. An 18-holes Stableford bogey competition for the Veterans' trophy, presented by the proprietors of the *Electrical Journal*, will be played and is open to any golfer of fifty-five years of age or over who is connected with the electrical industry. The entrance fee (to be paid on the day) is 5s. There will also be an 18-holes Stableford bogey foursomes competition for the Sir Felix Pole cups, open to all competitors playing in the national final.

At Little Aston there will be an 18-holes medal competition for the Visitors' Rose Bowl presented by the Electrical Wholesalers' Federation (entrance fee 5s). The Golf Club charges are:—£1 per day, including morning coffee, lunch, green fee, tea and gratuities; 10s 6d exclusive of morning coffee and lunch; caddies (if available) £1 per day. The dinner in the evening will be held at the Grand Hotel, Birmingham (8 for 8.30 p.m.), when the chair will be taken by Sir Henry Self and Lord Cobham will be the principal guest and speaker. Applications for tickets (37s 6d each), should be made to Mr. F. A. Bartlam, Albion Buildings, Vesey Street, Birmingham, 4.

Entry forms for the golf competitions are obtainable from any area secretary, or from Mr. Frank Farthing, Magnet House, Kingsway, London, W.C.2.

Labour and the Domestic Scene

Automation, Nuclear Power and Nationalization to be Discussed

FROM AN INDUSTRIAL CORRESPONDENT

THE preliminary agendas for the Trades Union Congress (5th-9th September) and the Labour Party Conference (10th-14th October) both reflect the domestic scene. The Labour Party agenda consists largely of motions which, in their totality, amount to an inquest on the 1955 general election. T.U.C. motions are mainly concerned with strikes, negotiating machinery, trade union structure, production and industrial development.

Surprisingly, the Labour Party agenda gives more attention to the problems of automation and nuclear power than does the agenda for the T.U.C. Only three T.U.C. motions deal specifically with automation.

The Association of Supervisory Staffs, Executives and Technicians, " appreciating that we are on the verge of a new industrial revolution through the introduction of electronic and other forms of control mechanisms, is concerned about its possible effect upon the livelihood of the workers of this country." It calls for an examination of the probable effects of automation on productivity; the livelihood of the workers; and their standard of living.

The United Patternmakers' Association asks that " immediate steps be taken to ensure that the introduction of automation and automatic processes . . . shall not be used to lower the standards of the workers, but rather should be harnessed by Government direction to improve the whole standard of life for everyone."

The National Union of General and Municipal Workers " believes that Great Britain stands at the threshold of technological advances which will present the trade union movement with new opportunities for securing higher living standards for its members." To resolve what it considers will be the attendant " new and complex human, social and economic problems " of these opportunities, the motion calls for " a greater measure of workers' participation in industry through the medium of joint consultation."

A motion of the Association of Scientific Workers " welcomes the decision to proceed with the construction of nuclear power stations in Great Britain," but " urges H.M. Government to extend and accelerate the development of nuclear power stations."

In the comparable section of the Labour Party Conference agenda a number of motions express views similar to those of the Supervisory Staffs, Executives and Technicians' motion.

One motion sees in automation an opportunity to introduce a planned economy and greater control of private industry, as a means of preventing unemployment and " greater hardships to the workers." Another thinks that " if our economy is not to collapse from the contradictions which will emerge with full-scale automated production, the translation of our country into a Socialist one is a historical necessity." A more practical motion instructs the National Executive Committee to set up a committee to study the industrial and social problems of automation and to report to the next annual conference.

A full-blooded motion, which " believes that Britain's future economic prosperity may largely depend upon the rapid development of the industrial use of nuclear power," wants the National Executive Committee to adopt a policy, to be implemented by the next Labour Government, which will among other things:—

(*a*) Maintain public ownership and control of the production and distribution of nuclear energy and major associated by-products, and ensure that subsidiary developments are controlled by licence from the public authority.

(*b*) Provide the necessary resources for an expanded programme of research into the applications of nuclear energy.

(*c*) Accelerate the building of nuclear power plants under public control and the development of other uses of nuclear energy.

(*d*) Ensure that there are an adequate number of nuclear scientists, engineers, technicians and technologists, by providing more science teachers, improved training facilities at schools, technical institutes and universities.

Nationalization

Nationalization does not figure so prominently in either agenda as in former years. A rather weak motion from the Amalgamated Engineering Union for the T.U.C. once again " instructs the General Council, in conjunction with the Labour Party Executive, to formulate a plan for the nationalization of suitable sections of the engineering, chemical and building industries." The Plumbing Trades Union plumps for the nationalization of the building and building materials industries. The Chemical Workers' Union wants private finance corporations to be brought under social ownership, " by the establishment of Government public finance corporations (local and national) which would guarantee loans to people on a fair and equitable basis."

The National Union of Railwaymen, in a motion no doubt born out of its recent experiences, " regrets the Government intention not to provide any aid to the railways other than the Treasury guarantee on borrowings." It " considers that the present serious financial position of the Transport Commission, and the inevitable worsening in the intervening years (namely, to the completion of the modernization plan) which are and will be due largely to arrears of maintenance, the heavy burden of compensation to previous shareholders, the present Government's transport policy and . . . interest charges on fresh borrowings, will react to the detriment of the users of transport and the workers in the industry." Financial stability, the motion suggests, can be reached " either by the State taking over all capital charges, less the amount which the transport system can reasonably be expected to earn or, alternatively, by a block grant scheme designed to protect the Commission, the transport user, and the transport worker against increased costs which are outside their control."

For the Labour Party Conference, there are a number of motions re-affirming belief " in common ownership of the means of production and distribution." The Manchester (Wythenshawe) Constituency Labour Party calls upon the National Executive Committee to report on the methods which will be necessary in order to " transform the nationalized undertakings into Socialist industries " and " the relative priorities for the socialization of the remainder of capitalist industry."

Although the motions which appear on the preliminary agenda for the Labour Party Conference do reflect to a great extent the opinions and aims of the rank and file, the mechanics of the Conference are such that not one-tenth of them can reach the Conference floor.

INDUSTRIAL NEWS

Trade with Soviet Bloc

In October, 1954, the Board of Trade published a list of goods the export of which to the Soviet bloc (as distinct from China) was controlled for strategic reasons and which might not therefore be exported to the Soviet bloc countries without approval. List I showed the goods which were subject to embargo and List II those of which the export was subject to quantitative limitation. Since those lists were published the controls, which continue in force, have been subject to revisions made as a result of consultations with the other countries who co-operate with the United Kingdom in this respect. The necessary changes in export licensing control have already been made and were announced on 8th July, 1955. Corresponding consequential changes to the Transhipment Open General Licence of 8th January, 1955, and to the Strategic Goods (Control) Order, 1954, covering the embargoed goods, come into force to-day (Friday), 26th August. The latter Order now applies to North Viet Nam in addition to the Soviet bloc and China. Applications for licences or requests for further information should be addressed to the Board of Trade, Export Licensing Branch, Atlantic House, Holborn Viaduct, E.C.1.

Copies of the Amendment to the Transhipment Open General Licence and of the Strategic Goods (Control) (Amendment) Order, 1955 (S.I. 1955 No. 1280) can be obtained from H.M. Stationery Office, price 3d.

Among the goods removed from the October, 1954, lists are generators, generating sets and synchronous condensers of a maximum continuous rating of 10,000 kW or over and stators and rotors therefor; certain coaxial type cables; electric motors not elsewhere specified of over 5,000 b.h.p. or more but under 12,500 b.h.p. one-hour rating, and their control gear; and turbines of 2,000 b.h.p. and over (other than those incorporated in generator sets) and wheels and blading therefor.

Additions to List I (goods subject to embargo) include generators, turbo-generators and synchronous condensers of a maximum continuous rating of 60,000 kW and over, and stators and rotors therefor; turbines of 85,000 b.h.p. and over, all types, and wheels and blading for these machines; certain cable-making machinery; certain insulated cables, including submarine cables of all types; and certain line communications transmitting equipment.

Among the additions to List II (goods subject to quantitative limitation) are generators, turbo-generators, synchronous condensers and motor generator sets of from 5,000 kW to 60,000 kW and stators and rotors therefor; motors, not elsewhere specified, between 5,000 b.h.p. and 12,500 b.h.p. one-hour rating and their control gear; all types of turbines of between 7,000 b.h.p. and 85,000 b.h.p.; and turbines of 2,000 b.h.p. and over, other than those designed for driving electric generators, and wheels and blading therefor.

Television Transmitters for Australia

The Australian national television service is expected to be inaugurated towards the end of next year upon the completion of the first two Government-controlled stations and studio centres, at Sydney and Melbourne. Most of the equipment for these two stations is being supplied by Marconi's Wireless Telegraph Co., Ltd., under the terms of a contract worth more than £250,000 which was obtained through their Australian associates, Amalgamated Wireless (Australasia), Ltd.

The installation in each case will consist of an 18 kW vision and a 4 kW sound transmitter, together with a 5 kW vision and a 1 kW sound transmitter as standbys. In addition, Marconi's will supply the combining units for both main and standby transmitters, a twin transmission line, an 8-stack aerial for each station, and various ancillary equipment. For the Melbourne station, where the studio is to be connected to the transmitter by radio, a further order has been obtained for centimetric vision links and the v.h.f. sound links.

The main vision transmitters are of the same type as those which Marconi's are supplying to the B.B.C. for the new Crystal Palace station in that they are designed to handle N.T.S.C. type colour transmissions as well as the normal black and white. The Australian stations will operate in Band I to a 625 line standard, and the sound transmissions will be frequency-modulated.

Lancashire Dynamo in Australia

Lancashire Dynamo Holdings, Ltd., has announced the formation of a new company in Australia — Lancashire Dynamo Coates Pty., Ltd. This development follows upon nearly thirty years' representation of Lancashire Dynamo companies in Australia by Coates & Co. Pty., Ltd. As well as selling the industrial range of the group, some products are now being manufactured in Australia, in particular rectifiers and associated transformers. The new company will handle all inquiries in the States of Victoria, South Australia and Tasmania from its head office in Melbourne and a branch office will cover New South Wales. Representation in Queensland will be made by Coates & Co. Pty., Ltd., and in Western Australia Harris Scarfe & Sandovers, Ltd., will continue to represent companies in Great Britain and will act as agents for Lancashire Dynamo Coates Pty., Ltd., in connection with Australian-made equipment.

Guide to Broadcasting Stations

Since the publication of the last edition of "Guide to Broadcasting Stations" by the *Wireless World* there have been a very large number of changes in the operating frequencies of broadcasting stations throughout the world. This fact, together with the number of additional stations now in service, has necessitated a complete revision of the information included in the eighth edition, which is now available at 2s 6d from Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1.

All the 650 stations operating on long and medium waves are listed both in order of frequency and geographically. Some 1,600 short-wave broadcasting stations operating with a power of not less than one kilowatt are also listed, with their call signs, in order of frequency and geographically.

Leicester Home Life Exhibition

The annual Leicester and East Midlands Home Life Exhibition will be held from 7th to 17th September at the Granby Halls, Leicester. It will be opened by His Excellency the Hon. T. Clifton Webb, Q.C., High Commissioner for New Zealand. Electrical appliances and equipment will be shown and the East Midlands Electricity Board will have a comprehensive display of cookers, heating appliances and other domestic apparatus.

Next Week's Events

The two major events which commence next week are the British Association meeting, which opens in Bristol on 31st August and continues until 7th September, and the Engineering, Marine and Welding and Foundry Trades Exhibition, which commences at Olympia on 1st September and closes on 15th September.

Skegness Illuminations Competition

Skegness Urban District Council's Sun Castle, illuminated by "Atlas" colour change fluorescent floodlighting, was judged overall winner in the "Best Illuminated Premises Contest" at Skegness. This lighting scheme, which also gained first place in the "Entertainment Premises" section, used red, green and blue tubes in TW

fittings controlled by means of a 3-colour electronic automatic dimmer unit. The contest was judged by Mr. H. Payn, manager of the Boston District of the East Midlands Electricity Board.

Safe Driving Awards

Over 260 drivers employed at various depots of the North Western Electricity Board have obtained safe driving awards. Among them is Joseph Greenwood, of Blackburn, who has gained a star bar, marking 21 consecutive years of safe driving.

Instrument Maker's "Open" Day

On 27th July the Baldwin Instrument Co., Ltd., held an open day and exhibition of equipment at its works in Dartford, Kent. Over 300 visitors saw the latest range of electronic, nucleonic and industrial instruments as well as air cylinders and valves manufactured by the company. In the laboratory there were prototype instruments which are scheduled for future production.

E.A.W. Sheffield Branch

The Sheffield Branch of the Electrical Association for Women recently celebrated its 21st birthday, when a visit was paid to Hardwick Hall, Derbyshire. At the celebration dinner the chair was taken by Mrs. E. Boot, J.P., branch president; Miss N. Balls, J.P., chairman of the Association, spoke on the E.A.W.'s present work, and Mrs. H. Riley, branch chairman, spoke of the activities of the Sheffield Branch.

Television Studio Equipment Order

An order for television studio equipment has been placed with Marconi's Wireless Telegraph Co., Ltd., by Granada T.V. Network, Ltd., the Monday to Friday programme contractors for the Manchester area. The contract was placed through Granada's agents, Kinematograph Equipment, Ltd. The equipment is to be installed in a studio in the Granada Television Centre, now being built in Manchester. The equipment to be supplied includes five Mark III television cameras with 4½in image orthicon pick-up tubes, vision and sound equipment for a central control room, telecine auxiliary equipment, and vision mixing equipment. The latter is to be of the "ABCD" type which permits mixing from one superimposition to another.

P.O.A. Conference

The annual conference and "Minibition" of the Purchasing Officers' Association will be held from 29th September to 2nd October at Cliftonville. The programme of meetings, which will be held in the Winter Gardens, will include a sectional meeting at which Mr. K. A. M. Barton (sales director, Midland Silicones, Ltd.) will give a talk on silicones, and a discussion between Mr. J. B. Scott (sales director, Crompton Parkinson, Ltd.), Mr. T. Swaminathan, Minister (Commercial) of the High Commission of India, Mr. Yoshio Ohkawara, Secretary (Commercial) Japanese Embassy, and representatives of other Eastern Governments, on "East-West Trade." Social events will include a civic reception and dance in the Winter Gardens and a dinner-dance at the Grand Hotel. Over 100 firms, from all sections of British industry, will be exhibiting at the "Minibition," which will be held in the Winter Gardens, adjacent to the conference hall.

"Power-Seal" Batteries

Oldham & Son, Ltd., of Denton, Manchester, have improved their "Major" type of car battery by manufacturing dry-charged plates which are impervious to moisture. During recent years it has been general practice for batteries to be supplied by manufacturers in a dry charged state, unfilled, for final preparation by the garage or supplier. Such batteries ordinarily suffer loss of power during storage as a result of attack by moisture in the air gradually reducing the charge, and necessitating a prolonged charge after filling with acid before the battery is ready for service.

The "Power-Seal" process of Oldham & Son has the effect of waterproofing the plate throughout and sealing the initial factory dry charge until the battery is required for service. The sealing process is immediately affected by sulphuric acid and the battery can be put into use within half an hour of being filled.

Water-Heater Display

A very neat and simple window display of Creda "Crusader" water heaters was recently arranged at the Headrow, Leeds, showroom of the Yorkshire Electricity Board. A photograph of the display is reproduced herewith.

"Crusader" water-heater display at Leeds

Cable Makers' Christmas Holiday

As Christmas Day this year falls on a Sunday the Joint Industrial Council for the Electrical Cable Making Industry states that it will be necessary in accordance with Clause 2 (a) of the agreement on payment for statutory holidays, for local establishments to select by agreement an alternative day. The Council recommends that in the event of Tuesday, 27th December, 1955, being declared a public holiday, it is desirable wherever possible that this day should be selected as the substituted day. The Council has also decided to confirm its previous decision in regard to payment for work done in the course of the Christmas holidays, namely:—All time worked on the day substituted for Christmas Day to be paid at the rate of double time; all time worked on Sunday, 25th December, to be paid at the rate of double time; time worked on Boxing Day to be paid in accordance with the J.I.C. General Agreement.

I.E.E. Scottish Golf Competition

The Hutcheson-Winning Golf Competition organized by the Scottish Centre of the Institution of Electrical Engineers, which was to have been held in May last, but was postponed, will now be held on 6th September at Gleneagles.

132 kV Oil-filled Cable Contract

As we mentioned in an article in our issue of 5th August, the first contract in the United Kingdom for 132 kV three-core oil-filled cable was placed with W. T. Henley's Telegraph Works Co., Ltd., earlier this year by the Central Electricity Authority for the North West, Merseyside and North Wales Division. The Authority has now placed with the company a contract involving further lengths of this type of cable on behalf of the Midlands Division for connections at Nechells

"A" and "B" power stations. It covers the supply and installation of 800 yd of 0·2 sq in cable and about 3,500 yd of 11 kV single-core and low-voltage multicore auxiliary cables. As for the previous contract, the 132 kV cable will be designed to operate at a maximum stress of 100 kV/cm.

Trade Prospects in Australia

A report on the economic and commercial conditions in Australia by Mr. H. J. Gray, United Kingdom Senior Trade Commissioner in Australia, has been published for the Commercial Relations and Export Department of the Board of Trade by H.M. Stationery Office (price, 7s 6d net). This includes sections on the development of the electricity supply industry (thermal and hydro-electric) and the growth of the electrical manufacturing industry. Much of the information given has already been covered by Mr. N. G. Crowley in his article on "Australia's Electrical Future" published in our issue of 18th March last. Appendices to the report, however, give figures of Australian electrical imports and exports for 1953-54, which are later than those given by Mr. Crowley. These are shown in the following tables with the figures for 1952-53 included for comparative purposes:—

IMPORTS

Class	£A thousand f.o.b. Year ended June	
	1953	1954
Batteries and accumulators ...	353	419
Cable and wire, covered ...	3,531	1,893
Communication equipment, including radio	2,970	2,434
Dynamo-electric machinery...	6,544	6,857
Heating and cooking appliances	263	549
Lamps, filament	403	1,165
Protective equipment ...	729	543
Regulating, starting and controlling apparatus	5,104	4,466
Sparking plugs and parts ...	314	535
Transformers and rectifiers ...	4,206	4,348
Electrical machinery and appliances, n.e.i.	2,242	2,909
Total	26,659	26,118

EXPORTS

Class	£A thousand f.o.b. Year ended June	
	1953	1954
Batteries and accumulators ...	335	424
Communication equipment ...	479	556
Other electrical appliances ...	815	985
Total	1,629	1,965

City and Guilds Handbooks

We have received five handbooks from the Technology Department of the City and Guilds of London Institute, 31, Brechin Place, South Kensington, London, S.W.7. They are:—General regulations, with the 1955-56 calendar and particulars of examinations; regulations and syllabuses for telecommunications and electrical subjects; examination results 1954; prize list 1954; and the Department's report for 1953-54.

This report shows that the number of entries in the three electrical engineering grades in 1954 totalled 39,122 (against 36,870 in 1953); 35,962 candidates sat for the examinations (against 31,994). During the year under review the Electrical Engineering Group Committee completed a preliminary review of the Department's provision for the electrical industry. It has been decided to prepare two courses, one for electrical technicians and the other for electrical craftsmen. Throughout its work the Sub-Committee for Courses for Electrical Technicians has borne in mind the various reports of the Institution of Electrical Engineers and in particular the two recent conferences of the Institution on this subject.

English Electric Traction Orders

The English Electric Co., Ltd., has received, through the Crown Agents, an order for the Malayan Railways covering twenty main-line 1,500 h.p. diesel-electric locomotives valued at about £1½ million. The locomotives will haul express trains, up to 450 tons in weight, on the Singapore-Kuala Lumpur-Prai line. They weigh 96 tons each and are of the Co-Co type, embodying the English Electric 12SVT diesel engine. Operating speed on the Malayan Railways at the moment is limited to 45 m.p.h.; with the new locomotives a maximum of 60 m.p.h. will be possible.

Further information is now available on the order which the company received earlier this year from the Indian Railway Board. The contract covers twelve 3,000 V, 3,120 h.p. d.c. locomotives of the Co-Co type, each weighing 111 tons, the total value being approximately £800,000. The locomotives are generally similar to the seven 3,600 h.p. 1,500 V English Electric locomotives which went into service earlier this year on the Central Railway, India, operating from Bombay. The twelve additional locomotives will operate on the Howrah-Burdwan section of the Eastern Railway, Calcutta area, where the Indian Railway Board has planned an extensive 3,000 V electrification. They will be the first 3,000 V locomotives to operate in India.

Industrial Training Schemes

We have received from Hackbridge & Hewittic Electric Co., Ltd., a copy of their new leaflet, "Hackbridge & Hewittic Junior and Post Graduate Training Schemes" (Publication No. T2), which outlines the company's engineering training schemes for students. The training schemes cater for young men from county or secondary schools and from grammar schools or technical colleges, and for post graduate applicants, and the schemes are described under these headings in the booklet. The schemes are supported by the Ministry of Labour and National Service which will, under normal circumstances, grant deferment annually until the end of the course to each trainee provided that his progress is satisfactory. The booklet is well illustrated with photographs of sections of the company's works and of installations for which the company is responsible throughout the world.

Stella South

Last week we described Stella South in our series "1954 Power Stations" and on page 341, in referring to the cooling water pumps, printed the figure 7,301 h.p. for the driving motor. This should, of course, have been 730 h.p.

Illuminating Engineering Course

A course in illuminating engineering commencing in September at the Borough Polytechnic, Borough Road, S.E.1, will include experimental work in a recently equipped illumination laboratory. Enrolments take place during the week commencing 19th September, and a prospectus can be obtained on application to the secretary, Borough Polytechnic, Borough Road, London, S.E.1.

Trade Announcements

Wild-Barfield Electric Furnaces, Ltd., informs us that owing to extensions which are in progress at its works, it has decided to suspend the visits of organized parties which usually take place at this time of the year.

Mr. F. J. Hutchings, after thirty years in the wholesale trade, has joined the cable division of **Connollys (Blackley), Ltd.,** as their representative in the Midlands area.

The Birmingham branch of the **Z Electric Lamp & Supplies Co., Ltd.,** is now Berkeley Street, Birmingham, 1 (telephone: Midland 7621/2).

Dimplex, Ltd., has appointed Mr. H. Savory to the sales staff of its northern branch at 40, Longley Lane, Northenden, Manchester. Mr. Savory was previously with Thorn Electrical Industries, Ltd.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 10th September:—

FLEXON. No. B.736,001, Class 9. Thermostats and parts; and metal bellows, being parts of apparatus.—Flexonics Corporation, Maywood, Cook County, Ill., U.S.A. Address for service, c/o Gill, Jennings & Every, 51-52, Chancery Lane, London, W.C.2.

BLACK BEAUTY. No. 741,170, Class 9. Electrical condensers.—Sprague Electric Co., North Adams, Mass., U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

No. 741,404 (design), Class 9. Electric batteries and accumulators.—H. Chambers, trading as Ulster Battery Co., 18, Howard Street South, Belfast.

IDOTRON. No. 742,261, Class 9. Photo-electric measuring devices and parts.—J. F. Crosfield, Ltd., 2, Elthorne Road, London, N.19.

COMMASTER. No. 742,337, Class 9. Telephone and loudspeaker apparatus for intercommunication.—Neltic, Ltd., Neltic House, Charteris Road, London, N.4.

Electrical Manufacture in Brazil

From a Correspondent

IN the case of several types of electrical equipment Brazilian production now meets the needs of the local market as regards quality and price. One well-organized, highly-mechanized factory of electric kitchen appliances, for example, is selling 20,000 units monthly and has begun exporting to Uruguay, Venezuela and other South American Republics.

The manufacture of electric motors, started in 1944, has made spectacular progress and the demand is growing rapidly. Brazil, which required and imported 60,000 units annually before the last war, produced 80,000 in 1949 and 350,000 in 1954. Imports decreased from 2,416 tons in 1953 to 1,030 in 1954. Production includes three-phase induction (¼ to 200 h.p.), single-phase and universal motors.

Increasing production of motors has facilitated expansion of other electrical industries and imports of refrigerators, for instance, have declined from 9,299 tons in 1951 to 159 tons in 1954; many well-known international makes, as well as several Brazilian models, are now produced in the country.

Production of radio receivers increased from 50,000 units in 1947 to 600,000 in 1953. Practically all parts were imported in 1947, but all are now made locally. So, also, are the parts for television sets, except the valves, which will become available this year. An electronic valve factory, now nearly completed, will have a potential output of 5 million valves annually. It will produce 30 types, including cathode ray tubes and transmitter valves. The same firm is making loudspeakers, mica condensers, potentiometers and other essential pieces for the electronic industry.

Nevertheless, despite increasing local production of electrical materials and the elimination of certain items from the foreign trade returns, imports of many articles have actually increased owing to industrial expansion. Comparing 1945 and 1953, imports of radio accessories increased from 264 to 362 tons; electric generators coupled to i.c. engines, from 131 to 6,366 tons; electric generators and motors, from 2,522 to 4,161 tons; electric machine tools, from 437 to 13,412 tons; parts for electrical installations, from 1,010 to 1,396 tons; batteries, from 238 to 528 tons; and static transformers, from 696 to 1,979 tons.

The interest displayed by foreign manufacturers in the possibilities of the Brazilian market shows no sign of abating. Ericsson do Brasil has built a factory to produce telephone equipment in Sao Paulo, with an initial output of 50,000 telephones annually. R.C.A. Victor are to install plant to produce six million radio valves annually, as well as other electronic items, and double the present output of radio and television sets. Proposals are before the Commission for Economic Development for the manufacture of lamp sockets (Aktiebolaget Olaf Nyberg, of Sweden) and small electric motors (Adalberto Faggini).

In April President Cafe Filho appointed study groups to recommend measures to develop the heavy mechanical and electrical industries in Brazil. The first group will consider proposals to manufacture equipment for oil wells, refineries and generating machines. The second will deal with the more advanced stages of the electrical materials industry and the capital required for development. At a meeting of the Industrial Development Commission it was pointed out that lack of a heavy electrical industry threatened to interrupt the Government's electrification programme, as "Brazil cannot continue indefinitely to obtain foreign loans to finance imports. An increase of installed capacity to 4,000,000 kW by 1957 is guaranteed, but there is a limit to such financing."

ATOMIC TIME STANDARD

THE quartz clocks at the National Physical Laboratory were recently checked by means of an atomic standard. They will now keep time to 1 sec in 30 years and the Laboratory hopes to make it 1 sec in 300 years. This is the first time that quartz clocks have been calibrated with an atomic standard to an accuracy greater than that given by astronomical time. It is a complete break with the traditional system of time-keeping based on the earth's rotation.

The astronomical method of checking is no longer good enough because the earth's rotation fluctuates during the year. To overcome these fluctuations the observations must be averaged over several years. The quartz clocks cannot be relied upon to keep uniform time for such long periods. So, although it is possible to know the average value of the unit of time with great accuracy, the value at any particular instant can only be known with a much smaller degree of accuracy. There is the added disadvantage that the results can only be calculated some years in arrears, when sufficient astronomical data have been accumulated.

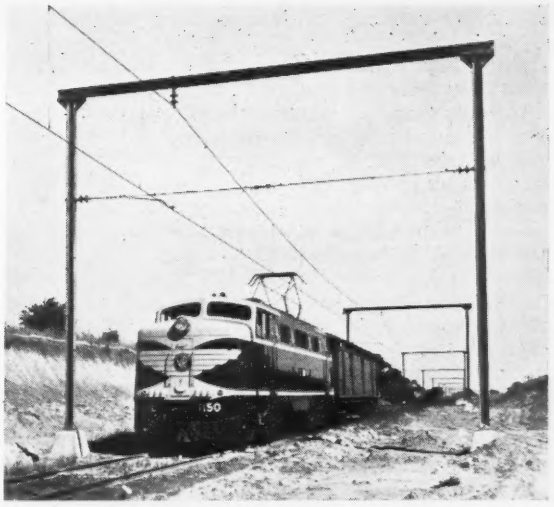
There is thus a need for a standard which is not only more accurate but gives results much more quickly. The only alternative seems to be that offered by the natural vibrations of the atom. The cæsium atom is particularly suitable because of its unusual magnetic properties. It behaves like a tiny compass needle, which can, however, set either along the direction of a magnetic field or in exactly the opposite direction. The state it is in can be recognized by the direction in which it is deflected by a magnet. It is possible to produce a change from one state to the other by applying an alternative magnetic field, but only when the frequency corresponds exactly to a particular value which is a fundamental constant of the cæsium atom. The reason for this is that a small but definite amount of work must be done to change the atom from one state to the other. The frequency required is 9,192,631,830 c/s, but this figure may be revised slightly.

The present cæsium standard comprises a 5ft copper tube supported on two heavy pedestals and a system of pipes and pumps maintaining a high vacuum inside it. Around the tube are a number of coils which are used to apply the appropriate magnetic fields. A smaller copper tube leads away from the middle of the main chamber to a small transmitter, similar to that used in radar equipment, which supplies the rapidly alternating field. The cæsium atoms are evaporated from an oven at one end of the tube. They stream through the appropriate field and are focused on to a detector at the other end. When the frequency of the transmitter is just right, the atoms spin and are deflected away from the detector so that there is a sudden drop in the number received. The transmitter can thus be set at the cæsium frequency and used in turn to calibrate the quartz clocks.

The pioneer work on atomic time standards was carried out in the United States and a knowledge of the experiments made at Columbia University, the National Bureau of Standards and the Massachusetts' Institute of Technology has been of great help in the developments at the National Physical Laboratory.

Railway Electrification in Victoria

MELBOURNE SUBURBAN SYSTEM AND THE GIPPSLAND EXTENSION



English Electric 2,400 h.p. locomotive on test on the Gippsland electrified main line

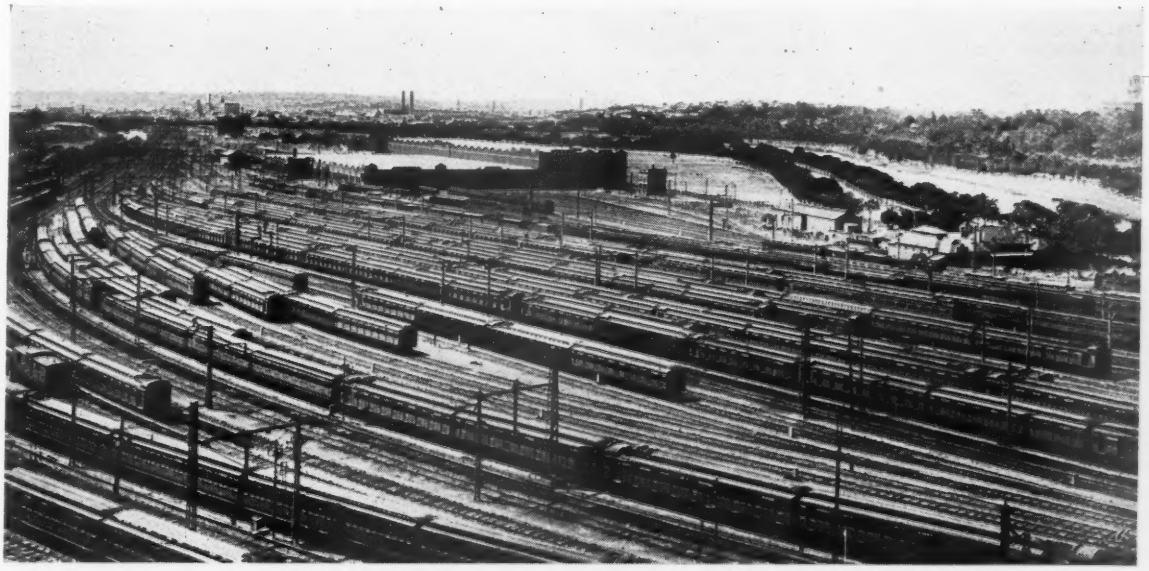
ELECTRIFICATION of main-line railways in Australia is developing in the form of extensions to suburban systems which have been operating for a number of years. This process is now taking place in New South Wales, as described in the *Electrical Review* of 17th June, while in the State of Victoria it has advanced a step further by the completion last year of 42¾ miles of electrification from the previous Melbourne suburban terminus at Dandenong to Warragul on the Gippsland main line of the Victoria Government Railways.

The first move to electrify the Melbourne steam suburban passenger service was made in 1896 when a proposal was submitted by a representative of the General Electric Company of America, whose report suggested the conversion of part of the Melbourne suburban lines. Although opposed because of financial stringency, it aroused parliamentary interest and in 1898 a select committee was appointed to examine the possibilities of electric traction.

The next important development occurred in 1907 when Mr. C. H. Merz, of London, was engaged to make a comprehensive investigation into the electrification of the Melbourne suburban lines. In 1911 Mr. Merz was requested to review his initial plan and apply the latest practices to it. The modernized plan was ultimately approved by the Government and in December, 1912, electrification was authorized at an estimated cost of £3,991,000. The first world war retarded the plan and it was not until 20th June, 1918, that the first turbo-generator at Newport power station began to supply energy. The first electric train ran in 1918, though it was not until 28th May, 1919, that electric traction was officially inaugurated. When the last section of the scheme was finished the system covered 150 route-miles and 350 track-miles. Capital expenditure totalled £6,270,000 and at the time the electrified system was one of the largest in the world.

In this scheme 141 miles of 20 kV cable had to be laid underground and 153 miles of overhead high-voltage line erected, while the necessary traction motor and control apparatus had to be fitted to the carriages. To-day the electrified lines comprise about 173 route-miles operated at 1,500 V d.c., or 439 single track-miles, including sidings. They extend from the central station at Flinders Street

This view of the Jolimont yard near Flinders Street Station gives an idea of the heavy traffic there



for varying distances, the longest being to Frankston, 26½ miles.

When the first line was electrified the number of suburban passengers yearly was 103 million and by the end of 1926 the passenger journeys had grown to 160 million. With the development of a metropolitan tramway system and an increasing number of private motor cars in use, the passenger journeys have tended to stabilize, the yearly number of journeys at 30th June, 1953, being 155 million.

The greatest number of passenger journeys in one day was just over a million during the visit of the Duke of Gloucester for Victoria's centenary celebrations. Over 500,000 passengers passed through Flinders Street Station and during the day 2,562 trains arrived at and departed from Flinders Street and Princes Bridge stations, 21 per cent above normal. This record traffic figure was probably eclipsed on the day of the arrival in Melbourne of Queen Elizabeth and the Duke of Edinburgh in February, 1954, but passenger traffic records for that day were not kept.

Normally about 139,000 passengers arrive at these two stations during the morning peak period and 133,000 leave for suburban stations in the evening peak. Sixteen platforms, with a total length of 1¼ miles, are in constant use. Flinders Street, one of the busiest stations in the world, deals with almost all Melbourne's suburban train traffic, a situation without parallel among cities of comparable size.

For handling the daily peak period traffic 112 trains, mainly of seven cars each, are used; at other times 61 trains, mainly four-car sets, are in service. Each motor coach is powered by four motors each of 140 h.p. continuous rating with single-reduction gears of 3·2 to 1. Each motor coach has one pantograph of the sliding pan type, a dynamotor supplying control and lighting current, a motor-driven air compressor and the necessary control gear.

Multiple-unit electric trains operating the suburban services are composed of sliding-door and swing-door cars, there being 618 of the former and 275 of the latter in service. The sliding-door type has been found the more suitable and has been adopted as a standard for all future coach construction. A seven-car standard electric train seats 628 passengers, but handles crush loads exceeding 1,000.

A big programme of replacement of the existing cars is in progress. Electrical equipments for 30 suburban trains are being manufactured under contract with the English Electric Co., Ltd., and contracts have also been entered into for the supply of 210 coaches. Parts for 90 motor coaches will be supplied by the Gloucester Railway Carriage & Wagon Co., Ltd., for assembly in Australia, and 130 trailer coaches have been ordered from Australian contractors.

The new cars will be of a design evolved after due consideration of modern overseas suburban car developments and after some months of service with a prototype car. In addition to providing reasonable seating accommodation, they will permit of a maximum crush load being carried under much better conditions than at present.

Power for the suburban trains is distributed from the Newport station of the State Electricity Commission as a 20 kV, three-phase, 25 c/s supply. It is distributed by underground cables to substations in the inner suburban area. Overhead transmission is used from these inner substations to the substations in the outer suburbs, the conductors being suspended, in most cases, from extensions of the structures carrying the d.c. contact wire over the railways tracks.

At present 23 substations feed this power to the trains. Six of these have mercury arc rectifier plant, and the remainder are equipped with rotary convertor plant for supplying the 1,500 V d.c. to the overhead contact wires. The largest substation is at Jolimont, about a mile from Flinders Street Station. It contains four large convertors of 4,500 kW continuous capacity. In 14 of the smaller substations the equipment is entirely automatic.

Supply System Conversion

A major project now being undertaken is the conversion of the existing substation plant to operate from a 22 kV 50 c/s power supply derived from the State Electricity Commission network. The programme is scheduled for completion by 1970, by which time the 25 c/s supply from Newport power station will no longer be required.

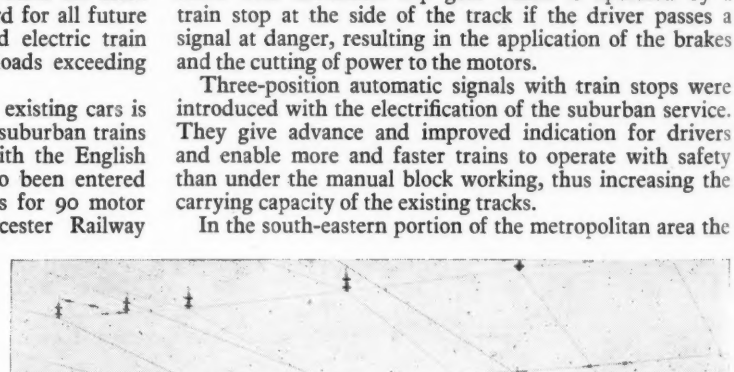
To increase the efficiency of the suburban electrified service, all the units in the power supply system—substations, circuit-breakers, cables and overhead contact lines are continuously supervised from a single modern power operation room in the Flinders Street Yard. The whole electrified system is shown on a large diagram where any change in conditions is signalled by a corresponding change in the coloured indicator lamps.

A depot for the maintenance and repair of overhead equipment near Flinders Street Station is equipped with fast motor vehicles fitted with the necessary gear for rapid repair of faults in the overhead system.

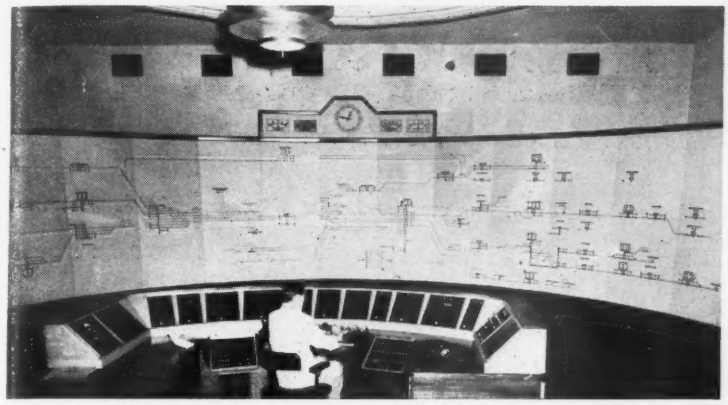
The present motor coaches have International General Electric electro-magnetic control with six automatic accelerating steps in series and five in series-parallel. In addition to the normal dead man's handle, the trains are fitted with automatic trip gear which is operated by a train stop at the side of the track if the driver passes a signal at danger, resulting in the application of the brakes and the cutting of power to the motors.

Three-position automatic signals with train stops were introduced with the electrification of the suburban service. They give advance and improved indication for drivers and enable more and faster trains to operate with safety than under the manual block working, thus increasing the carrying capacity of the existing tracks.

In the south-eastern portion of the metropolitan area the



Seven-car electric train of the Melbourne suburban system



Power operations room at Jolimont; the control desk and mimic diagram are by the G.E.C.

suburban electrified service terminates at Dandenong, 18½ miles from Melbourne. Dandenong is the gateway to Gippsland, where at Yallourn and Morwell Victoria's great deposits of brown coal are situated. The part duplication and electrification of the Gippsland line from Dandenong to Traralgon (79 miles) is now in progress, and electric traction for all traffic was extended to Warragul on 21st July, 1954. Sixteen substations and twelve track-sectioning cabins are needed for this electrification project.

Power for the whole scheme is taken at 22 kV, 50 c/s, three-phase from the State Electricity Commission's system at five points. Pumpless steel tank rectifier equipments have been supplied by the British Thomson-Houston Co., Ltd., who were also responsible for the a.c. circuit-breakers controlling the feeder and rectifier supplies. Each rectifier unit is housed in a cubicle measuring only 7ft high by 4ft 6in deep by 3ft 2in wide and is rated continuously at 1,500 kW. Substations are equipped with one or two units, a second unit being installed where gradients are severe or where a lengthy feed would be involved with a substation temporarily out of action.

Rectifier transformers are of the oil-immersed, self-cooled outdoor type, with a 12-phase quadruple zig-zag connected secondary winding. The twelve l.v. leads of the transformer are connected to two rectifier tanks, each containing six anodes.

All substations and track-sectioning cabins are under remote supervisory control from Warragul with apparatus supplied by the General Electric Co., Ltd. Control and indication are provided for the 22 kV a.c. feeder circuit-breakers, the 22 kV a.c. circuit-breakers for the rectifiers, the 1,500 V d.c. track feeder circuit-breakers, and the 2·2 kV a.c. circuit-breakers controlling signalling supplies, and indication only of the rectifier d.c. circuit-breakers, the 22 kV busbar voltage, low substation battery voltage, and the isolation of substations. Closing of the d.c. circuit-breakers at substations forms part of the automatic sequence of operations when the a.c. breakers feeding the rectifiers are closed.

The system also affords indication and control of the track-sectioning cabin 1,500 V d.c. track feeder circuit-breakers, and indication of low battery voltage in these cabins. There is telephone communication between all substations and track-sectioning cabins, as well as between these points and the central control room.

A mimic diagram at Warragul shows the main 22 kV a.c. circuit, and the 2·2 kV a.c. and 1,500 V d.c. circuits. Circuit-breakers are represented by coloured lamps which show whether each is open or closed. On the control desk are mounted selector switches and push-buttons for the operation of all circuit-breakers.

In general, the equipment is similar to that already employed in the Melbourne suburban area. However, because the length of the pilot circuits in the Gippsland line installation was too great for d.c. operation, this system uses voice-frequency transmission over one pair of pilot wires for each group of substations. The voice-frequency principle permits simultaneous transmission over one circuit of control signals to effect different operations.

The supervisory equipment is divided into six groups, three serving substations east of Warragul and the remainder those to the west; each group of substations is connected to the control room by a separate two-wire circuit. Substations 1, 4 and 7 are connected to Group 1; 2, 5 and 8 to Group 2; 3, 6 and 9 to Group 3 and so on. Thus, if there is a fault on one control circuit, only one substation in three is affected. Moreover, because adjacent substations are in different groups, the feeder circuit-breakers at each end of a section can be closed simultaneously. This arrangement is of considerable advantage when the breakers at both ends of a section trip together on overload.

For operating passenger and goods traffic over the line the English Electric Co., Ltd., has supplied 25 Co-Co locomotives of 2,400 h.p., with rheostatic braking.

LARGE AUSTRIAN POWER SCHEME

The International Bank for Reconstruction and Development has just approved a loan equivalent to $10 million for the Lünersee hydro-electric power project under construction in Western Austria. This project is expected to earn the equivalent of $1½ million per annum from power exports to the Ruhr and to South-West Germany and will also make more power available to the western provinces of Austria, i.e., to Vorarlberg and the Tyrol. The greater part of this loan will be made in European currencies and the remainder in dollars. About $7 million will be used to import equipment and the rest will be used for the purchase of Austrian-made equipment. The Philadelphia National Bank is participating in the loan to the extent of $153,000. This is the second loan by the I.B.R.D. to Austria and the second made there for a project to generate electric power. The first loan, amounting to $12 million, was made in July, 1954, to finance the Reisseck-Kreuzeck hydro-electric project from which power will be exported to Italy.

The Lünersee power project will have a generating capacity of 190,000 kW. Its main purpose is to supply power for export at periods of peak demand. The Lünersee will be used as a reservoir and a dam will be built to raise storage capacity of the lake and its water supply will be increased sixfold by diverting the run-off of a glacier into the lake and by pumping excess water up from a basin situated below the new power station. The project includes the construction of a power station and the installation of generators and pumps; the building of a small dam across the lower end of the lake; construction of a diversion system from the Brandner glacier; construction of six miles of tunnels, siphons and penstocks to bring water down to the power plant and to return pumped water to the lake; and the construction of a transmission line to the German frontier. The power generators will also serve as motors to run the pumps; low-cost, off-peak thermal power from Germany will be used for this purpose.

Electrical Research

Recent Publications Issued by the E.R.A.

AMONG the recent research reports issued by the British Electrical and Allied Industries Research Association a number of topics of interest to the more practical type of electrical engineer are dealt with. For instance, in Report Ref. F/T181, "Methods of Determining Thermal Resistivity of Soil *in situ* for the Calculation of Cable Ratings" (price 15s) three methods of soil thermal resistivity determination are described. The first of these is the hitherto accepted one employing buried spherical or cylindrical heaters. This method, whilst reliable, requires at least several days for each measurement.

To satisfy the need for more rapid methods two have been worked upon and tested by the E.R.A. and are described in the report. One of these is the "transient needle" method in which a long thin heater is placed in the ground and heated for about 15-20 min, the thermal resistivity of the soil being calculated from temperature and time readings.

The second rapid method involves the assessment of thermal resistivity from the soil constitution and moisture content as determined from samples suitably taken. It has so far been developed only for soils of clay, sand or a mixture of these. Both the rapid methods may be expected to give results agreeing with measurements by the sphere method within ± 10 per cent except in certain extreme conditions.

Electrons in Polar Materials

The properties of slow electrons in polar materials are of importance for a number of physical processes. In Report Ref. L/T312, "Electrons in Polar Materials," by M. J. Buckingham (price 6s), a variation method is used to calculate the ground state energy of an electron in an ionic crystal. Contrary to the case for weaker interaction, it is shown that the lowest state is one in which the electron density is localized if the interaction with the lattice is stronger than a critical value. The method is not suitable for the discussion of higher energy states when the interaction is strong.

In Report Ref. L/T284, "Self Energy of Electrons in Lattice Fields," by M. Gurari (price 9s), a new method is developed to calculate the self-energy of an electron in a field such as the polarization field of an ionic lattice. With the help of the variational method, it is shown that the energy calculated from perturbation theory always gives an upper limit to the lowest energy level, however strong the interaction. Application to electrons in ionic crystals gives a lower (better) value for this energy than was found in previous theories. The effective mass of the electron is about twice the electronic mass.

The dielectric properties of methyl methacrylate resin (without plasticizer) have been investigated over a range of temperature from -50 deg to $+160$ deg C and a frequency range from 65 c/s to 24,000 Mc/s. The results of this work are described in Report Ref. L/T315, "The Dielectric Properties of Methyl Methacrylate Resins," by E. Rushton, B.Sc. (price 9s). The material has comparatively poor dielectric properties, the loss tangent ($\tan \delta$) decreasing steadily with frequency at room temperature from about 0·06 at power frequencies to 0·01 at cm wavelengths and the permittivity (ϵ) diminishing from about 3·6 to 2·6 in the same range. The material absorbs less than 1 per cent by weight of water, and this water has only a small effect on the dielectric properties.

At temperatures of about 60 deg C and above there is strong dipole absorption, peak values of the order of 0·10 being recorded and the permittivity increasing to values of about 5. The dielectric behaviour at these higher temperatures can be explained in terms of Fröhlich's model. It is considered that at ordinary room temperature there may also be dipole absorption, with a main absorption band centred around a very low frequency (of the order of 1 c/s), and superposed on this, a residual absorption varying but little with frequency and with a very wide range of relaxation times.

In Report Ref. G/T292, "Flameproof Electrical Apparatus. Flange-Gap Protection with a Fifth Series of Industrial Atmospheres," compiled by A. P. Paton, B.Sc., A.M.I.Mech.E., A.M.I.E.E. (price 7s 6d), figures for the maximum experimental safe gap and statistical maximum safe gap are given for flameproof enclosures with flanges of $\frac{1}{2}$in radial breadth with the following combustibles:—acetone, normal butyl alcohol, ethyl ether, ethylene, ethylene oxide, heptane and methyl-ethyl ketone. The figures are compared with earlier results obtained with the same combustibles using a similar enclosure with flanges of 1in radial breadth. An improved method of determining the statistical maximum safe gap is also used and the results compared with those found by the original method.

Report Ref. M/T114, "An Automatic Counter for the Measurement of Impulsive Interference," by J. Miedzinski, B.Sc. (price 12s)describes a device for counting the number of occasions in a predetermined number (up to 50) of total switching operations when an electrical appliance causes the indications on an interference measuring set of C.I.S.P.R. type to reach or exceed a prescribed value. Use of the counter has been found to effect a saving of 80 per cent in the time of an operator carrying out the sequential test prescribed in B.S. 800-1950 for appliances producing discontinuous radio interference. The device may have application in other types of production testing.

Copies of the above reports are obtainable, at the prices indicated in parenthesis, from the British Electrical and Allied Industries Research Association, Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

Plant Breakdown in Ceylon

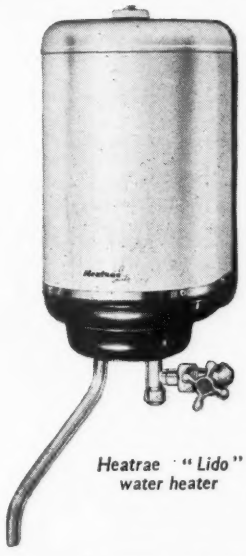
Our Colombo correspondent reports that one of the 8,500 kW generators in Ceylon's hydro-electric station at Laxapana has broken down and the Department of Electricity has appealed to the public to reduce their use of electricity, particularly during peak hours. Street electric lighting has been restricted. The repairs to the generator are not expected to be completed until the middle of September and Mr. E. B. Cocks, a senior engineer of a London firm of consulting engineers, has been asked to report on the breakdown.

The Colombo Municipal Council is to ask the Prime Minister, Sir John Kotelawala, to appoint a commission to inquire into the entire working of the Laxapana hydro-electric scheme. The Council is asking the Prime Minister to hand over the distribution of electricity in Colombo, pointing out that it is the only local body in the island that has not been given authority to distribute electricity within its administrative limits.

NEW ELECTRICAL EQUIPMENT

Water Heaters

The new "Lido" range of electric storage type sink water heaters announced by HEATRAE, LTD., Heatrae Works, Norwich, are made in 1½ and 3 gal sizes and are available in white, cream, green or blue finishes. For an average household supply the 1½ gal model can have one of two loadings, 750 W or 1 kW and the larger model has alternative loadings of 1 or 2 kW. Both are of the non-pressure type and water temperatures are thermostatically controlled. The voltage range is 200/220 or 230/250 a.c. The outer casing is finished in stoved synthetic enamel with a black ebonized base and chromium trim, outlet spout and valve.



Heatrae "Lido" water heater

A noteworthy feature is the extremely simple yet secure method of fixing. This takes the form of a separate bracket which can be readily and accurately placed in its position and does away with the necessity of offering the heater to the job. It is so designed that when the heater is in place, it is fully hard back against the wall so that a moisture and dust-proof seal is formed with the rubber backing ring provided.

The prices of the "Lido" range for both loadings are £10 5s (1½ gal) and £11 15s (3 gal) plus £4 and £4 11s 8d purchase tax in the United Kingdom.

Multiplier for Current Transformer Testing

The Petch-Elliott current transformer testing set, which has been manufactured by ELLIOTT BROTHERS (LONDON), LTD., Lewisham, London, S.E.13, for many years, is known as a simple and accurate means of obtaining ratio and phase angle errors of current transformers. Hitherto, the testing set has met the requirements of c.t. testing down to Class "B" as specified in B.S. 81. With a new multiplier, however, the ranges of any existing Petch-Elliott testing set may be extended to cover transformers to Class "C" B.S. 81 and also Class "S" B.S. 2046.

Elliott multiplier

The multiplier is connected to the current transformer testing set by the leads supplied. Two links are transposed, and the standard c.t. and the c.t under test are connected to the multiplier; testing then proceeds normally. Under these conditions, using the ×5 range of the testing set, the errors covered are ±10 per cent on ratio and ±400 minutes phase angle.

The multiplier is portable and carries a comprehensive instruction plate. The dimensions are 6¾in by 6¾in by 7½in and the weight is 4½ lb.

Miniature Circuit-Breaker

DORMAN & SMITH, LTD., Ordsal Electrical Works, Manchester, have introduced a new miniature circuit-breaker known as the Dorman "Loadmaster." It combines compactness and high performance with low initial cost and provides complete protection by means of a thermal-magnetic mechanism operating on all overloads with time delay, and instantaneously under fault conditions. Erosion resisting silver-tungsten contacts are incorporated to ensure long contact life; the wiping action in operation keeps the contacts clean.

The "Loadmaster" is available as a single pole circuit-breaker unit and in a range of distribution boards. These distribution boards are designed to house from 1 to 12 units for single pole and neutral 250 V a.c. supplies. Four basic sizes of box for surface or flush mounting (2, 4, 8 and 12 way) are adaptable, by the use of blanking plates, to cater for intermediate sizes. The price of the basic single pole unit in 5, 15, or 30 A ratings, is 17s 6d list.

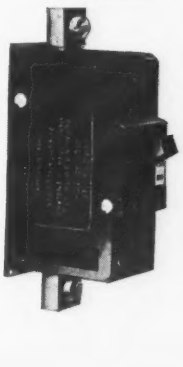
Reflector Fires

Two new additions have been made to the "Cosyglo" range of fires manufactured by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. Available in September, the 2 kW screen fire, which completely covers the majority of fire-openings, has glass side panels illuminated by a 60 W amber sprayed lamp fixed at the base of the fire. The lamp can be used independently of the heating elements, which are controlled by two separate switches. The illumination of the side panels not only transforms the unit into an attractive firescreen but at the same time provides a useful diffused light for use when viewing television.

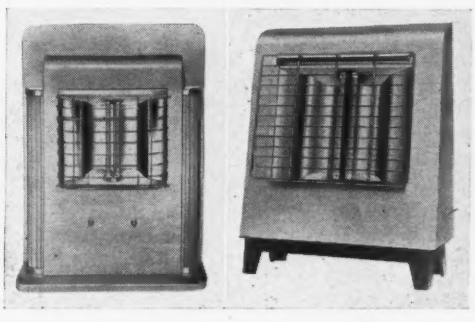
The multi-parabolic dispersive reflector is designed on optical principles and spreads the heat over a wide area. Finished in hammered bronze and having dimensions of 27½in high by 21in wide with a depth of 8¾in, it can be used either in a fire-place or as a portable, a projection at the rear of its base providing the necessary stability. The price of the fire, catalogue number D2814, is £11 10s plus £4 4s 1d purchase tax in the United Kingdom.

The new "Cosyglo" 2 kW portable reflector fire is of contemporary design, and also available in September. The dimensions are 19⅝in high by 17⅛in wide by 7in deep. This model is compact and easy to carry from one room to another, and is finished either in silver-bronze or green with a black base. The price, catalogue number D2813, is £5 15s, plus £2 2s 1d purchase tax.

Dorman "Loadmaster" circuit-breaker



The G.E.C. "Cosyglo" screen fire (left) and contemporary styled portable reflector fire



REPORTS and DIVIDENDS

The Oriental Telephone & Electric Co., Ltd.—The annual meeting will be held on 14th September. In his circulated statement, Mr. E. J. Bunbury (chairman) says that his address covers the last year of their operation of the Singapore and Johore Bahru undertakings which were taken over by the Singapore Telephone Board and the Government of the Federation of Malaya, respectively, on 31st December last. He is unable to give any estimate at present of the likely date when the company will be put into voluntary liquidation or when suitable arrangements will be completed for the disposal of the subsidiary company, the China & Japan Telephone & Electric Co., Ltd. In view of the delay in the date of the annual meeting, the board declared on 19th July last a second interim dividend at the rate of 2s 4·8d per stock unit, which is equivalent to 12 per cent on the issued ordinary stock before the recent capital repayment. A final dividend of 1s 9·6d per stock unit is now recommended, to bring the total dividend for 1954 to 25 per cent before the capital repayment. The board does not intend to pay an interim dividend in December next, and the question of a dividend for 1955 will be considered in 1956 in the light of circumstances then obtaining and in particular of the likely date of liquidation. It is the present intention of the board to make no further capital repayments until the company goes into voluntary liquidation, as it considers this to be in the best interest of stockholders.

Hall Telephone Accessories, Ltd.—Proposals are being submitted to shareholders which are designed to enable the company to enter the field of automation. The entire issued capital of James Gordon & Co., automatic control engineers, has been acquired through which a connection is being obtained with Panellit Incorporated of America, of which Mr. A. F. Sperry is president. James Gordon & Co. are forming an English Panellit company to take a licence to manufacture and sell in Great Britain and some other territories certain of the American company's automatic devices and systems. The Gordon acquisition is linked with Hambros Bank, which, with its clients, will be putting £248,416 new capital into the Hall business by subscribing for 354,880 10s shares at 14s each. The directors state that Hall Telephone Accessories will continue its existing business, but it will be able to employ its factories to greater advantage by undertaking the manufacture of the James Gordon products, which hitherto have been subcontracted by that company. It is the knowledge, experience and connections of James Gordon in automation, it is stated, which have been the guiding

The Week's Price Changes

Company or Board	Nom. Value	Middle price 22nd Aug.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1955 Highest	1955 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	79½	−2	3	3	3 15 6	94½	79
Brit. Elec. 1974/77	100	77½	−1	3	3	3 17 5	93½	77
Brit. Elec. 1976/79	100	83½	−1	3½	3½	4 3 10	98½	83
Brit. Elec. 1974/79	100	95	−3	4½	4½	4 14 9	109	94½
Overseas Electric Supply								
Calcutta Elec.	£1	22/-		6†	6†	5 9 0	22/6	20/9
East African Power	£1	23/-		7	7	6 1 9	24/6	19/9
Nigerian Elec.	£1	23/6		10	10	8 10 3	27/-	22/6
Palestine Elec. "A"	£1	21/-		Nil	Nil	—	22/9	21/-
Perak Hydro-Elec.	£1	20/-		6	10	10 0 0	21/6	17/9
Equipment and Manufacturing								
Aberdare Cables	5/-	12/3	−9d	12½	17½	—	14/6	11/-
Aerialite	1/-	6/6	+3d	88⅛	88⅛	—	6/7	5/3
Allen, W. H.	£1	77/6	−2/6	20	20	5 3 3	83/9	77/-
Aron Elec. Ord.	£1	55/-	−5/-	20	15	5 0 0	63/9	55/6
Assoc. Elec. Ord.	£1	87/6	−5/-	11¼	14	3 4 0	96/-	65/3
Automatic Tel. & El.	£1	70/-	−5/-	15	15	4 3 6	79/6	69/-
Babcock & Wilcox	£1	82/6	−7/6	12*	15	3 9 4	98/-	68/6
Baldwin, H. J.	2/-	5,-		20	20	8 0 0	5/6	4/4
Bakelite	10/-	34/-	+6d	12½	16	4 14 1	34/6	27/-
British Aluminium	£1	50/-	−1/3	10	12	4 16 0	58/-	35/3
B.I. Callender's	£1	46/-	−2/6	10	10	3 4 7	55/3	44/9
B.I. Callender's 6% Pref.	£1	23/-		6	6	5 4 4	26/6	23/-
British Thermostat	5/-	32/6	−1/3	27½	27½	4 4 7	35/-	22/6
British Vac. Cleaner	5/-	8/-		25	30	—	10/-	7/-
Brook Motors	10/-	46/3		20	20*	—	45/-	39/9
Brush Ord.	5/-	9/-		6	10	5 11 0	9/6	7/7
Bulgin, A. F.	1/-	7/9		30	45	5 16 2	8/-	4/-
Burco Dean	5/-	13/9		35	25*	—	23/-	18/9
Chloride El. Storage	£1	70/-		12½	17½	5 0 0	77/6	58/6
Clarke Chapman	£1	102/6		20	20*	3 18 1	102/6	68/9
Cole, E. K.	5/-	23/-	−2/-	27½	17½*	7 12 2	25/6	18/3
Cossor, A. C.	5/-	11/6	−1/-	10	10	4 7 0	14/-	8/9
Crabtree	10/-	31/3	−1/3	17½	20	6 8 0	34/6	29/3
Crompton Parkinson Ord.	5/-	17/-		20	20	—	19/9	16/-
De La Rue	5/-	19/9	−1/9	20	30	7 12 0	26/-	18/9
Decca	4/-	40/-	−2/6	35	56½*	—	48/9	31/-
Desoutter	5/-	35/-		20	25	3 11 6	35/-	25/6
Dewhurst	2/-	10/-		19	24	4 16 0	10/6	7/3
Dictograph Tel.	2/-	9/3	+1/6	20	20	4 6 3	7/6	6/6
Dubilier Condenser	1/-	4/6	−3d	25	25*	5 11 1	5/7	3/10
E.M.I.	10/-	27/6	+6d	8	10	3 12 9	37/-	25/3
Electrical Components	5/-	18/9		20	25	6 13 4	21/3	15/3
Elec. Construction	£1	35/-		15	8⅛*	4 17 2	41/3	31/6
Enfield Cable Ord.	£1	20/-		Nil	Nil	Nil	25/3	20/-
English Electric	£1	75/-	−7/6	10	12½	3 6 8	86/9	54/3
English Electric 3½% Pref.	£1	14/-	−9d	3½	3½	—	16/9	14/9
Ericsson Tel.	5/-	39/6	−6d	25†	20†*	2 10 8	46/6	29/-
Ever Ready	5/-	33/9		40	35*	5 3 8	38/-	22/3
Falk Stadelmann	£1	45/9		15	15	6 11 2	52/6	43/9
G.E.C. Ord.	£1	70/-	−2/6	12½	14	4 0 0	80/3	51/3
G.E.C. 6¼% Pref.	£1	23/9		6¼	6¼	5 9 5	28/4	23/6
General Cables	5/-	15/3		30	30	9 16 9	17/-	15/-
Greenwood & Batley	£1	57/6		17½	17½	6 1 9	57/6	54/6
Hackbridge Cable	5/-	19/6	−9d	20	20	5 2 7	22/6	14/-
Hackbridge & Hewittic	5/-	19/6	−6d	25	30	—	33/9	23/9
Hall Tel. Acc.	10/-	18/9		10	10	5 6 8	22/6	11/-
Heatrae	2/-	5/3	−6d	12½	15	5 14 3	5/9	4/3
Henley's	10/-	18/-	−6d	10½	10½	5 16 0	21/3	17/-
Holophane	5/-	17/6	−6d	20	25	7 2 10	19/9	16/-

* After scrip issue. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

factor in assessing the purchase rather than profits and net assets.

Hackbridge & Hewittic Electric Co., Ltd.—Of the 200,000 ordinary shares of 5s each at 12s 6d per share issued 197,379 were taken up as rights on provisional allotment letters. Applications were received for 285,293 excess shares. Those who applied for up to fifteen shares will receive allotment in full. The remainder will be allotted by ballot, successful applicants receiving twenty shares or such lesser amount as they may have applied for.

in Electrical Investments

Company or Board	Nom. Value	Middle price 22nd Aug.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1955 Highest	1955 Lowest
Equipment and Manufacturing—continued								
Hoover	5/-	45/-	−6d	45	70	—	52/6	40/-
I.C.I.	£1	52/-	−1/-	15	10*	3 17 0	61/9	38/3
Intl. Combustion	5/-	21/6	−6d	20	25	—	24/6	16/3
Johnson & Phillips	£1	43/-	−1/6	15	15	6 19 6	52/6	41/-
Lancashire Dynamo	£1	55/-	−1/3	14	15	—	56/3	37/3
Laurence, Scott	5/-	18/-		20	12½*	3 9 0	19/6	14/6
Lister, R. A.	£1	32/6	−3/6	12	9·3*	5 13 3	40/-	30/6
London Elec. Wire	£1	53/3	−1/3	10	12½	4 14 4	61/3	50/6
Lucas, J.	£1	46/3	−3/3	10·8	7½*	3 4 6	56/6	41/6
Marryat & Scott	2/-	12/3		25	30	4 18 0	13/-	9/6
Mather & Platt	£1	73/-x.d.		15	13·4*	3 13 4	75/-	48/-
Metal Industries	£1	28/3	−1/3	9	9	6 7 5	38/-	28/-
Midland Elec. Mfg.	£1	52/6		15	10*	3 16 2	55/-	44/-
Morphy-Richards	4/-	30/-		40	35*	4 13 4	35/-	27/-
Murex	£1	60/9	−6d	15	15	4 18 4	66/-	49/3
Newman Ind.	2/-	2/9		10	10	7 5 6	3/6	2/4
Oldham & Son	1/-	3/9	−3d	17½	20	5 6 8	4/-	2/10
Parnall (Yate)	5/-	9/6	−3d	8	14	7 7 4	13/2	7/3
Parsons, C. A.	£1	87/6	−2/6	7½	10	2 5 9	100/-	56/-
Plessey	10/-	71/3	−5/-	30	20*	2 12 0	89/-	57/6
Pye Deferred	5/-	41/3	−2/6	20	12½*	3 0 7	47/6	28/6
Revo	10/-	13/9	−1/-	27½	9*	6 11 0	15/6	12/6
Reyrolle	£1	115/-	−5/-	13¾	15	2 12 2	127/6	89/-
Rheostatic	4/-	13/3		20	22½	—	14/3	9/3
Richardsons Westgarth	5/-	16/-	−1/9	15	15*	4 13 9	19/-	11/-
Scottish Cables	4/-	19/6		27½	27½	5 11 0	22/6	19/3
Smith (England), S.	4/-	17/6	−1/-	15	17½	4 0 10	20/-	15/-
Southern Areas	£1	33/9	−2/6	7½	10	5 18 6	38/-	27/6
Strand Elec.	5/-	11/3	−6d	17½	17½	7 15 7	11/9	8/6
Sturtevant	5/-	32/6	−6d	18·9	14·4†*	2 4 4†	35/9	21/-
Sun. Elec.	£1	35/-		15	15	8 11 6	35/-	33/9
Switchgear & Cowans	5/-	17/-		10	20	5 17 9	17/-	11/-
Taylor Tunnicliff	5/-	15/3		12½	15	4 18 4	16/3	11/3
T.C.C.	10/-	53/9		30	25*	4 12 7	53/9	41/
T.C. & M.	£1	33/6	+1/6	8½	8½	5 1 6	40/9	32/-
Telephone Mfg.	5/-	11/6		10	10	4 7 0	11/6	9/3
Thorn Elec.	5/-	23/-	−2/-	20	15*	3 5 2	33/-	13/9
Thornycroft	£1	45/-		15	15	—	47/6	34/6
Tube Investments	£1	100/-	−2/6	15	17½	3 10 0	107/6	72/6
Vactric	5/-	17/6	−2/-	10	15*	4 5 9	22/-	12/-
Veritys	5/-	10/-	−6d	12½	12½	6 5 0	11/-	7/-
Walsall Conduits	4/-	15/9	−1/-	70	70	—	67/6	50/-
Ward & Goldstone	5/-	36/3	−1/3	50	30*	4 2 9	45/-	36/-
Watford	2/-	8/3		22½	25	—	8/9	6/3
Westinghouse Brake	£1	100/-	−2/6	16	18	3 12 0	110/-	82/-
West, Allen	5/-	14/6		17½	15*	5 3 5	16/6	8/-
Wolf Electric	5/-	21/-		17½	20	4 15 3	21/-	16/1
Trusts, Transport and Communications								
Anglo-Am Tel.:								
A. Ord.	100	70½		6	6	8 10 2	88	72
Ord.	100	45		3¾	3¾	8 6 8	54½	45
Anglo-Portuguese	£1	24/6		8	8	6 10 7	27/-	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	20/6	−6d	50	22½*	5 9 6	24/3	19/6
Cable & Wireless:								
Ord.	£1	48/9	−2/3	9	10	4 2 1	54/-	39/6
4% Loan	100	92½		4	4	4 6 6	100/-	92
Calcutta Trams	£1	25/-	−6d	2½†	6†	4 16 0	26/-	20/-
Cape Elec. Trams	£1	19/-		5½	7½	7 18 0	19/-	16/6
Marconi Marine	£1	37/-	−1/-	10	10	5 8 1	41/3	33/-
Oriental Tel. Ord.	£1	82/6		16	16	—	102/6	96/6
Telephone Rentals	5/-	12/3		10	12½	5 2 0	13/6	9/6

Cape Electric Tramways (1949), Ltd.—The combined group net trading profit for the year to 30th June last is estimated at £130,000. It is proposed to pay a dividend of 6 per cent for the year (unchanged) and to raise the bonus from 1½ per cent to 2 per cent.

Broadcast Relay Service, Ltd.—Treasury consent has been obtained to the proposed 100 per cent scrip issue reference to which was made in our issue of 24th June. The new shares will rank for dividend from 1st April last and the directors expect to pay dividends totalling 12½ per cent, tax free, on the double equity for the year to 31st March next. An extraordinary meeting to create capital and effect the issue is called for 23rd September.

Uganda Government Loan.—Particulars were announced on Tuesday last of an issue of £4,000,000 of Uganda Government 4¾ per cent stock, 1968-73, at the price of £97 per cent. The proceeds of the issue will be re-lent to the Uganda Electricity Board and be used towards the financing of the development of the Owen Falls Hydro-Electric Scheme. Of the total issue £750,000 has already been taken up on behalf of Colonial Government funds and £250,000 is reserved for public subscription in Uganda.

Newton Brothers (Derby), Ltd.—The trading profits for the year ended 31st March last amounted to £271,355, as compared with £278,243 for the preceding year, and after deducting all charges, including £122,813 for taxation, the net balance is £122,558 (against £95,654). General reserve receives £40,000 and it is proposed to pay a dividend for the year of 12½ per cent (same), and a bonus of 7½ per cent (against 5 per cent), making a total for the year of 20 per cent (17½ per cent). The balance carried forward is £41,951 (against £38,937 brought in).

The Westinghouse Brake & Signal Co., Ltd., has offered to acquire for cash the issued capital, the convertible debenture stock and loan capital of Douglas (Kingswood), Ltd.

Desoutter Brothers (Holdings), Ltd., has declared an interim dividend of 7½d per 5s ordinary share, equal to 12½ per cent. This compares with an interim dividend of 6d per share, or 10 per cent, for 1954.

New Companies

J. Russell Electronics (Distributors), Ltd.—Registered 30th July. Capital £100. Retailers, wholesalers, importers, exporters and distributors of electrical and mechanical apparatus and accessories, etc. Regd. office: Triumph House, 189, Regent Street, London, W.1.

A. W. Seth, Ltd.—Registered 5th August. Capital £1,000. Manufacturers and distributors of, agents for

and wholesale and retail dealers in electrical goods, radio and television sets, etc. Directors: C. W. Seth and Mrs. Muriel K. Seth. Regd. office: 36, The Broadway, Joel Street, Northwood, Middx.

G. & B. Electro-Plastics, Ltd.—Registered 5th August. Capital £3,000. To acquire the business now carried on by F. W. Gilham, J. P. Brennan and F. F. Wells at The Old Brewery, Welwyn, and to carry on the business of manufacturers, producers and developers of and dealers in electron discharge devices, photo-electric cells, electron multipliers, etc. The first directors are not named.

C. Smith & Son (Wholesale Electrical), Ltd.—Registered 2nd August. Capital £5,000. Directors: C. Smith and Jane Smith. Regd. office: 362, Westborough Road, Westcliff on Sea.

Jaques Barnard, Ltd.—Registered 15th July. Capital £1,000. Electronic engineers and contractors, radio and television engineers, etc. Directors: T. Jaques and J. R. Barnard. Regd. office: 2, Young Street, Doncaster.

L. T. Hall, Ltd.—Registered 26th July. Capital £5,000. Electrical contractors and engineers, electrical manufacturers, etc. Directors: L. T. Hall, C. S. Hall and Mrs. Madge Hall. Regd. office: 110, Goldhawk Road, London, W.12.

Arber & Walker Electric, Ltd.—Registered 5th August. Capital £1,000. Directors: E. Arber and H. F. Walker. Regd. office: 20, Dalewood Avenue, Sheffield, 8.

Auto Supplies (Electrical), Ltd.—Registered 6th August. Capital £1,000. Manufacturers and repairers of and dealers in electrical equipment for motor cars and other vehicles, etc. Directors: J. W. Johnson, Daphne J. Johnson, J. Dawson, Ena Dawson and S. H. Hibbins. Regd. office: 46, Lynton Road, Peterborough.

John Hardiment (Heating), Ltd.—Registered 17th August. Capital £2,000. Heating, ventilating, air conditioning, dust and fume collecting, drying, dehydration, electrical and general engineers, etc. Directors: J. C. H. Hardiment and Mrs. Mary Hardiment. Regd. office: The Causeway, Burwell, Cambs.

Goodonics, Ltd.—Registered 17th August. Capital £100. Heating, hydraulic, gas, electrical, turbine, mechanical and general engineers, etc. The first directors are to be appointed by the subscribers.

Vanrix, Ltd. — Registered 17th August. Capital £100. Objects and other particulars are similar to Goodonics, Ltd. (q.v.).

Telerenters (London & Provincial), Ltd.—Registered 17th August. Capital £1,000. Manufacturers and distributors of, agents for and wholesale and retail dealers in electrical goods, radio and television sets, etc. The first directors are to be appointed by the subscribers. Solicitors: Osmond Bard & Westbrook, 14-18, High Holborn, W.C.1.

Watson Products (Ealing), Ltd.—Registered 17th August. Capital £100. Wholesale and retail dealers in electric and other lamps, fluorescent tubes and lighting equipment, valves and electric bulbs, etc. Directors: Irene M. Watson and Harry Feneron. Regd. office: 195, Uxbridge Road, W.13.

Diponics, Ltd.—Registered 17th August. Capital £100. Electrical engineers and contractors, etc. The first directors are to be appointed by the subscribers.

H. A. West (X-Ray), Ltd.—Registered in Edinburgh 3rd August. Capital £15,000. Mechanical, electrical and consulting engineers, etc. Directors: H. A. West, Mrs. A. K. West and A. E. Ritchie. Regd. office: 41, Watson Crescent, Edinburgh.

Littlewood Bros. (Electronics), Ltd.—Registered 16th August. Capital £100. Manufacturers of and dealers in radio, electrical and mechanical apparatus of all kinds, etc. Directors: D. Littlewood, G. Littlewood and D. C. Herbert.

Panellit, Ltd. — Registered 16th August. Capital £100. Manufacturers, importers and exporters, designers and constructors of control equipment, instruments, valves, appliances and apparatus of all kinds for use in the field of automation, electronics and instrumentation, etc. Directors not named. Regd. office: Dalston Gardens, Stanmore, Middx.

Electrical Overseas Equipment, Ltd.—Registered 10th August. Capital £100. Exporters, importers and suppliers of and dealers in electrical appliances of all kinds, etc. Directors: W. Keen and C. A. Wilmot-Smith. Regd. office: 15, West Street, Harrow on the Hill, Middx.

Increases of Capital

Pirelli-General Cable Works, Ltd.—Increased by £1,000,000, in 100,000 "A" and 100,000 "B" shares of £5 each, beyond the registered capital of £1,000,000.

Vactric, Ltd. — Increased by £200,000, in £1 6 per cent cumulative preference shares, beyond the registered capital of £400,000.

Park Bros. Ltd.—Increased by £40,000, in 20,000 ordinary and 20,000 6 per cent cumulative preference shares of £1, beyond the registered capital of £64,000.

M.K. Electric, Ltd., has recently increased its authorized capital to £1,500,000.

Liquidations

Dalmere Electronics, Ltd.—Particulars of claims by 31st August to the liquidator, Mr. S. P. Heath, Joseph W. Shepherd & Co., 78, King Street, Manchester.

H. Lawrence Electrical, Ltd.—Meetings of members and creditors on 15th September at 91, Moorgate, London, E.C.2, to receive an account of the winding-up by the liquidator, Mr. H. Scott Thompson.

Bankruptcies

J. H. Pickwell, trading as J. H. Pickwell & Co., retailer of electrical goods and handicraft materials at 79, London Road, East Grinstead, Sussex, and as an electrical engineer and contractor at 108, London Road, East Grinstead.—Trustee, Mr. J. S. Bradley-Hole, 7, Old Steine, Brighton, 1, appointed 9th August.

W. J. Layton, 148, Studley Road, Redditch, Worcs, formerly carrying on business at 102, Evesham Street, Redditch, electrical engineer.—Trustee, Mr. R. K. Clark, Somerset House, 37, Temple Street, Birmingham, 2, Official Receiver, released 8th August.

L. J. Anthony, carrying on business in co-partnership with another at 6, Dolphin Lane, Boston, under the style of Dolphin Electric Co., electrical, radio and television engineer.—Trustee, Mr. C. G. Compton, 2, New Street, Boston, released 21st July.

H. Brown, 14, Abbey Drive, Luton, Beds, lately carrying on business at 109a, Park Street, Luton, radio and electrical engineer. — Last day for receiving proofs for dividend 30th August. Trustee, Mr. C. A. Taylor, 6, The Parade, Northampton, Official Receiver.

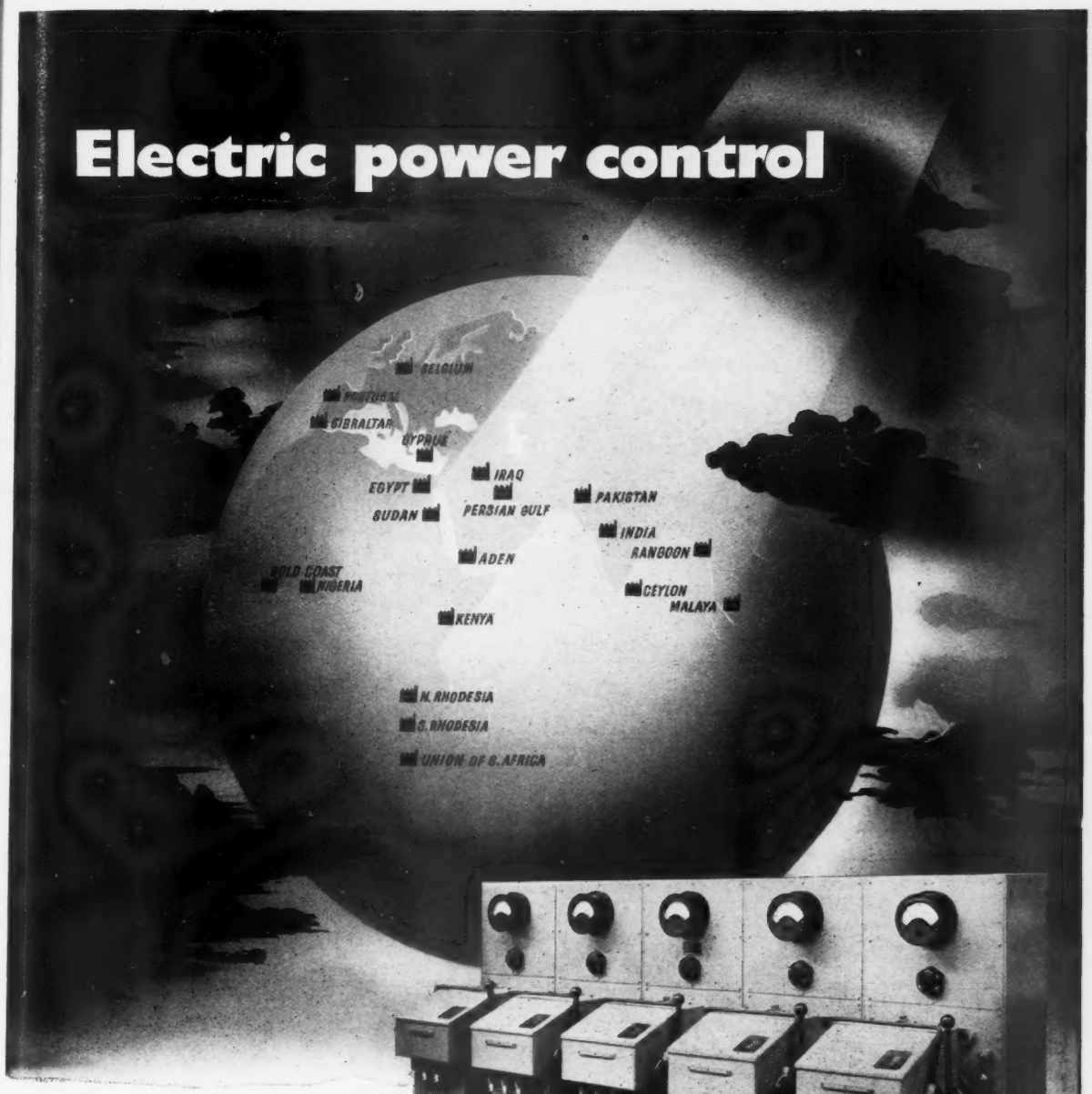
A. Fielder, 314, Shortheath Road, Erdington, and 4, Cooksey Lane, Birmingham, trading under the style of A. Fielder & Co., radio and electrical retailer.—Third and final dividend of $\frac{1}{16}$d in the £ payable on and after 31st August at the Official Receiver's office, Somerset House, 37, Temple Street, Birmingham, 2.

H. Pryor, carrying on business as W. Pryor at 36, Low Hill, Liverpool, 6, electronic engineer.—First and final dividend of 7d in the £, payable at 5, Rumford Place, Liverpool, 3.

Magee Bend Dam

The British Consulate-General, Houston, Texas, has informed the Export Services Branch of the Department of Overseas Trade that the U.S. Army Corps of Engineers, Fort Worth, proposes to commence construction before 30th June, 1956, of the Magee Bend Dam at an estimated cost of $50 million. The Dam, which is to be built across the Angelina River, approximately forty-five miles south-east of Lufkin in the State of Texas, is expected to form an artificial lake forty miles long and is to provide for flood control, water conservation and hydro-electric power. The hydro-electric plant to be installed is to have a capacity of 45,000 kW but detailed specifications and bidding forms are not expected to be published until the early spring of 1956. No further details are available at present.

Electric power control



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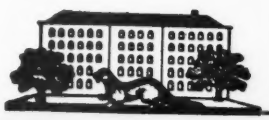

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GENERATION AND DEVELOPMENT

Generation and Sales in July

The July returns of the Ministry of Fuel and Power show that a total of 5,115 million kWh was generated in July, a decrease of 521 million kWh as compared with June but an increase of 143 million kWh (2·9 per cent) as compared with July, 1954. The installed capacity at the end of last month was 21,090 MW, an increase of 23 MW during the month, and compares with 19,622 MW at the end of July, 1954.

The accompanying table analyses the sales of Area Electricity Boards in July. The national figures show an increase over the corresponding month last year of 2·7 per cent, but when corrected for weather conditions and working days, the increase is 10·1 per cent.

ELECTRICITY GENERATED AND PLANT INSTALLED*

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total†		
Central Electricity Authority ...	2,489	61	9·8	4,737	5	4,749	4,438	19,216
North of Scotland H.E.B. ...	28	—	1·0	43	35	82	80	623
South of Scotland E.B.	138	4	0·1	269	15	284	268	1,251
Total for July, 1955	2,655	65	10·9	5,049	55	5,115	4,786	21,090
Corres. total for July, 1954 ...	2,632	75	7·7	4,876	86	4,972	4,659	19,622
Inc. or dec., per cent	+0·9	−13·3	+41·6	+3·5	−36·0	+2·9	+2·7	+7·5
Total to date (7 months) 1955 ...	24,142	673	136·5	45,299	752	46,148	43,389	
Total for corres. 7 months, 1954	22,226	664	81·6	40,799	787	41,670	39,177	
Inc. or dec., per cent	+8·6	+1·4	+67·3	+11·0	−4·4	+10·7	+10·8	

* Comprising all generating stations controlled by the Central Electricity Authority, the North of Scotland Hydro-Electric Board, and the South of Scotland Electricity Board.
† Including generation by other methods amounting to 11 million kWh.

ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for July (million kWh)			Twelve Months Totals Ended 31st July (million kWh)		
	1954	1955	Inc. or Dec. %	1954	1955	Inc. or Dec. %
London	376·1	375·4	− 0·2	5,862·2	6,355·7	+ 8·4
South Eastern	243·3	244·0	+ 0·3	3,512·1	3,833·6	+ 9·2
Southern	290·0	295·2	+ 1·8	4,125·9	4,632·1	+12·3
South Western	162 7	164·1	+ 0·9	2,066·9	2,396·8	+16·0
Eastern	390·5	399·4	+ 2·3	5,689·0	6,292·2	+10·6
East Midlands*	344·3	361·8	+ 5·1	4,829·2	5,436·5	+12·6
Midlands*	467·5	454·3	− 2·8	6,546·7	7,198·4	+10·0
South Wales*	297·6	307·1	+ 3·2	3,767·9	4,167·8	+10·6
Merseyside and North Wales* ...	276·3	294·8	+ 6·7	3,696·5	4,229·8	+14·4
Yorkshire*...	457·4	475·4	+ 3·9	6,341·6	7,041·2	+11·0
North Eastern*	280·2	290·0	+ 3·5	3,778·4	4,124·1	+ 9·1
North Western*	504·0	498·9	− 1·0	7,113·0	7,670·6	+ 7·8
Total all Area Board.	4,089·9	4,160·4	+ 1·7	57,329·4	63,378·8	+10·6
Direct Supplies by Central Authority	106·6	149·0	+39·8	1,084·0	1,563·2	+44·2
Grand Total	4,196·5	4,309·4	+ 2·7	58,413·4	64,942·0	+11·2
Mainly Industrial Areas*	2,627·3	2,682·3	+ 2·1	36,073·3	39,868·4	+10·5
Mainly Non-Industrial Areas ...	1,462·6	1,478·1	+ 1·1	21,256·1	23,510·4	+11·6

*Those in which industrial consumers took over 50 per cent of the total sales in the preceding financial year.

Clady Hydro-Electric Scheme

Construction work on the power house for the Clady hydro-electric scheme in Co. Donegal will begin next month and the Electricity Supply Board expects to have the project in operation within two years. The Clady scheme will meet the local electricity requirements of Donegal and any surplus will be transmitted to the main E.S.B. system through Ballyshannon. The electricity will be generated at 10 kV and will be stepped up to 38 kV for transmission. The total capital cost of the project is in the region of £600,000 and when in full production it will have an annual output of 13 million kWh.

The station will be normally operated by remote control from the projected 5,000 kW sod peat station at Gweedore, about 5 miles away.

It will be equipped with a horizontal Francis type turbine which will be coupled to a generator of 4,000 kW output.

Revision of S. Wales Districts

The South Wales Electricity Board has agreed to take over from the National Coal Board responsibility for electricity supplies to 3,000 consumers in the Rhymney Valley area. Some of these supplies have already been transferred to the Board's system and the remainder will be transferred within the next twelve months. A necessary reorganization, to be brought into force in October, will result in the creation of two new Districts in place of the three existing Districts.

The new Districts will serve the following localities:—(a) Merthyr Tydfil and Taff Vale, Hirwaun, Aberdare and Mountain Ash with the main offices at Merthyr Tydfil. (b) Rhymney, New Tredegar, Bargoed, Blackwood, Crumlin, Newbridge, Abercarn and Mynyddislwyn with the main offices ultimately at Bargoed. The first of these Districts will form part of the Central Sub-Area (headquarters at Cardiff) while the second will form part of the Eastern Sub-Area (headquarters at Newport).

Risca (at present administered from Newbridge) will be included in the District served from Newport, and Taffs Wells (at present served from Pontypridd) in the Cardiff East District.

Belfast Electricity Profit

Belfast electricity undertaking made a gross profit of £516,782 in the year ended 31st March last. In his report to the Belfast Electricity Committee, Mr. R. P. Watson, city electrical engineer, states that "the full impact of loan charges in respect of the large development programmes in progress and contemplated, and recent wage awards, has yet to be felt." The financial statement shows that the revenue from the sale of electricity and from hire of appliances, etc., after deducting discounts and bad debts, amounted to £2,686,626, an increase of £221,657 over that of the previous year. The total net capital outlay at 31st March last amounted to £18,284,161, and the net debt on the undertaking was £11,691,732. Electricity sold in the Corporation's area during the year amounted to 427 million kWh—an increase of 32 million kWh over the previous year, and equivalent to an increase of approximately 8 per cent. Although there was a saving of more than 8,500 tons of coal, as a result of higher efficiency, the cost of generation rose by £42,301, because of the increased price of coal.

Plant for New Caledonia

The General Council of the French Overseas Territory of New Caledonia has just approved a project under which the Fund for Investment and Economic and Social Development will finance the establishment in New Caledonia of a hydro-electric plant with a capacity of 350 million kWh at an estimated cost of over $29 million.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 28th September from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1951

2225. Pittsburgh Plate Glass Co.—Electro-conductive articles. 29th January, 1951. (737371.)

4142. Standard Telephones & Cables, Ltd.—Railway signalling systems. 15th February, 1952. (737558.)

12790. Siemens & Halske Akt.-Ges.—Photo-electric cells. 30th May, 1951. (737731.)

21297. Metropolitan-Vickers Electrical Co., Ltd.—Apparatus for examining recurrent electrical waveforms. 9th September, 1952. (737455.)

24114. Electronatom Corporation. —Apparatus for the electrical precipitation of matter suspended in or carried by gases. 16th October, 1951. (737734.)

1952

5065. Elliott Bros. (London), Ltd.—Apparatus embodying a temperature-controlled element. 13th April, 1953. (737658.)

6306. Metropolitan-Vickers Electrical Co., Ltd.—Accelerometers. 18th February, 1953. (737460.)

9539. Southern United Telephone Cables, Ltd.—Means for indicating conditions of balance and unbalance in an electric bridge network. 15th April, 1953. (737743.)

12922. United Kingdom Atomic Energy Authority.—Electron-discharge devices. 22nd May, 1953. (737386.)

13146. Southern United Telephone Cables, Ltd.—Testing of the insulation of electric conductors. 26th May, 1953. (737746.)

13312. Chromatic Television Laboratories, Inc.—System for improving colour television pictures. 26th May, 1952. (737464.)

13608. Cossor, Ltd., A. C.—Electric plug and socket connectors. 17th April, 1953. (737662.)

15470. Abboflex, Ltd., and Birks, N. A.—Flexible conduit adaptors, connectors and the like. 28th May, 1953. (737569.)

15794. Busch-Jaeger Durener Metallwerke Akt.-Ges.—Indexing mechanisms for rotary electric switches. 23rd June, 1952. (737663.)

17240. Centre National de la Recherche Scientifique.—High power generators of sound- and ultra-sound waves. 8th July, 1952. (737467.)

17850. Electrische Apparaten- en Metaalwarenfabriek R. Blik N.V.—Suction cleaner devices. 15th July, 1952. (737750.)

18804. Dussek Bros. & Co., Ltd., Thompson, A. W., and Freeborn, A. S.—Electric cables or condensers. 9th April, 1953. (737573.)

19518. Standard Telephones & Cables, Ltd.—Tuning indicator valve of small dimension and a high sensitivity. 1st August, 1952. (737668.)

21764. National Research Development Corporation.—Ratemeter circuits. 30th November, 1953. (737577.)

23623. Reyrolle & Co., Ltd., A.—Interruption of reactive electric circuits. 10th September, 1953. (737673.)

25844. Standard Telephones & Cables, Ltd.—Germanium diodes. 9th October, 1953. (737579.)

26194. Thorn Electrical Industries, Ltd.—Luminescent materials. 30th September, 1953. (737474.)

29132. Edison Swan Electric Co., Ltd.—Fittings for electric lighting. 18th November, 1953. (737478.)

30144. General Electric Co., Ltd., Athill, W. F., and Hicks, D. G.—Overload relays and a.c. systems employing such relays. 18th November, 1953. (737680.)

30385. Partl, W.—Equipment for the simultaneous supervision of current consuming devices some of which are continuously and some of which are only intermittently in operation. 1st December, 1952. (737480.)

30535. Pye, Ltd.—Magnetic focusing device for cathode-ray tubes. 26th February, 1954. (737406.)

30657. Philips Electrical Industries, Ltd. —Electric discharge tubes for use at very high frequencies and circuits for such tubes. 3rd December, 1952. (737588.)

1953

636. Metropolitan-Vickers Electrical Co., Ltd.—Electric slip-ring assemblies. 16th November, 1953. (737489.)

1081. Rotax, Ltd.—Regulating means for dynamo-electric machines. 8th January, 1954. (737590.)

2280. Ferranti, Ltd.—Gas-filled electric discharge devices. 27th January, 1954. (737689.)

3874. General Electric Co., Ltd., and Richards, S. W.—Electric battery lighting units. 9th February, 1954. (737593.)

4275. General Electric Co., Ltd., Hawkins, F. S., and Ryde, J. W.—Electric photo-flash lamps. 16th March, 1954. (737594.)

5266. Philips Electrical Industries, Ltd.—Devices for indirect X-ray photography. 25th February, 1953. (737414.)

5544. General Electric Co.—Electroluminescent cells. 27th February, 1953. (737596.)

6288. Philips Electrical Industries, Ltd.—Holders for electric lamps. 6th March, 1953. (737597.)

6871. Telefonaktiebolaget L. M. Ericsson.—Devices for detecting electrical pulses. 12th March, 1953. (737417.)

8867. Federal Electric Products Co.—Terminal panel for electrical circuit-breakers. 31st March, 1953. (737603.)

8868. Federal Electric Products Co.—Automatic electric circuit-breakers. 31st March, 1953. (737604.)

9069. Standard Telephones & Cables, Ltd.—Automatic gain control arrangement using a pilot voltage. 1st April, 1953. (737499.)

11012. Canadian Industries (1954), Ltd. —Blasting initiators for electrical firing. 22nd April, 1953. (737608.)

11019. Dorman & Smith, Ltd.—Mounting of electric fuse bases for use in fuse enclosures. 15th April, 1954. (737708.)

11020. Dorman & Smith, Ltd.—Electric fuse box terminals for main cables. 15th April, 1954. (737709.)

12021. Radio Corporation of America.—Diplexer and sideband filter arrangement. 30th April, 1953. (737711.)

12023. Metropolitan-Vickers Electrical Co., Ltd.—Arrangements for the control of magnetrons. 27th April, 1954. (737712.)

12890. Western Electric Co., Inc.—Electric signal translating devices including transistors. 8th May, 1953. (737506.)

13274. Metropolitan-Vickers Electrical Co., Ltd.—Heat treatment of strip material by dielectric heating. 12th May, 1954. (737424.)

13911. Telefonaktiebolaget L. M. Ericsson.—Switching arrangements for automatic telephone systems. 18th May, 1953. (737509.)

14654. Appareillage Eléctrique L. K. L. —Electrical plug and socket contacts. 26th May, 1953. (737427.)

16786. Soc. Francaise Radio-Eléctrique. —Automatic frequency control of oscillators. 17th June, 1953. (737613.)

16902-3. Midland Silicones, Ltd., formerly Dow Corning, Ltd.—Resinous compositions. 18th June, 1953. (737515-6.)

18028. Decca Record Co., Ltd.—Radar display apparatus. 29th June, 1954. (737519.)

19176. Westinghouse Air Brake Co.—Impulse coded carrier remote control systems. 10th July, 1953. (737617.)

19630. English Electric Co., Ltd.—Liquid fuel heating appliances. 9th July, 1954. (737521.)

19968. Vanier, G.—On-load electric regulating switch. 18th July, 1953. (737522.)

20890. Western Electric Co., Inc.—Stabilized electrical networks. 28th July, 1953. (737526.)

21026. Licentia Patent-Verwaltungs-Ges. —Method for the manufacture of semi-conductors having excess conductive and deficit conductive regions with sharp borders. 29th July, 1953. (737527.)

21753. General Electric Co.—Electroluminescent cells. 6th August, 1953. (737622.)

22027. Philips Electrical Industries, Ltd. —Bucky cross grid diaphragms for X-ray apparatus. 10th August, 1953. (737623.)

24210. Etablissements Neyrpic.—Shaft connections, more particularly for hydro-electrical units. 1st September, 1953. (737627.)

27812. Western Electric Co., Inc.—Electron-discharge device. 9th October, 1953. (737775.)

27873. Creed & Co., Ltd.—Means to facilitate the handling of telegraph storage tape. 9th October, 1953. (737538.)

28605. Standard Telephones & Cables, Ltd.—Telephone sets. 16th October, 1953. (737541.)

28674. Staatsbedrijf der Posterijen, Telegrafie en Telefonie.—Arrangement in an automatic telecommunication exchange for determining which of a plurality of service classes a desired connection between two subscribers belongs. 16th October, 1953. (737778.)

28710. Tuttle, H. C.—Voice mufflers for telephone transmitters. 17th October, 1953. (737635.)

30265. Triggs, W. W. (Hart Manufacturing Co.).—Polarized electromagnetic relay. 2nd November, 1953. (737438.)

31696. Aircraft-Marine Products, Inc.—Electrical connectors. 16th November, 1953. (737643.)

32589. General Electric Co.—Electrical temperature responsive devices. 24th November, 1953. (737542.)

33128. Telefunken Ges., formerly Telefunken Ges. für Drahtlose Telegraphie.—Superheterodyne receivers for frequency modulated oscillations. 30th November, 1953. (737646.)

33535. Akt.-Ges. für Technische Studien. —Gas turbine power plants. 2nd December, 1953. (737648.)

33998. General Electric Co.—Magnetic amplifiers. 7th December, 1953. (737546.)

34770. General Electric Co.—Electric capacitors. 14th December, 1953. (737443.)

34926. General Electric Co.—Seals for electrical leads. 15th December, 1953. (737649.)

35288. Standard Telephones & Cables, Ltd.—Method of treating germanium or silicon for modifying the electrical or electro-optical conductivity. 18th December, 1953. (737445.)

36134. Standard Telephones & Cables, Ltd.—Printed or the like electrical circuits. 30th December, 1953. (737550.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Athlone.—17th September. Electrical installations in Athlone District Hospital. J. C. Costello, consulting engineer, 21, Leeson Park, Dublin.

Australia.—22nd September. Southern Electric Authority, Queensland. Two 33/11 kV transformers. (E.S.B. 16763/55. Ten/15007.)*

Bath.—31st August. City Council. Tenders invited from members of the National Register of Electrical Installation Contractors and/or members of the Electrical Contractors' Association for the electrical installation at 15, Circus, Bath. E. Dixon, town clerk, Guildhall.

Belfast.—17th September. Harbour Commissioners. Two electrically-driven drainage pumps at the Alexandra Graving Dock. Harbour engineer, Harbour Offices.

Birmingham.—10th October. Birmingham, Tame and Rea District Drainage Board invite tenders from electrical contractors who will be selected for nomination for electrical installation work in connection with the sewage purification works, Norton Green. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. 33 kV outdoor switchgear and ancillary equipment; h.v. and l.v. wood pole overhead lines for the Ardnamurchan-Morven district. (See this issue.)

Egypt.—28th September. Cairo Gas and Electricity Administration. 60,000 a.c. watt-hour meters. (E.S.B. 17037/55. Ten/15050.)*

India.—30th August. Stores Purchase Committee, Government of Mysore. 4,100 power service meters. (E.S.B. 17229/55. Ten/15104.)*

6th September. India Supply Mission, Washington. Electronic equipment. (E.S.B. 16893/55. Ten/15181.)* Three 12½-15 kW diesel-electric generating sets and six electric hand drills. (E.S.B. 17603/55. Ten/15159.)*

15th September. Damodar Valley Corporation Electricity Department. 60 121 kV and 35 37 kV station type lightning arrestors. (E.S.B. 17131/55. Ten/15071.)*

Irish Republic.—30th August. Dublin Board of Assistance. Electrical installation in hospital 11, St. Kevin's Institution. (E.S.B. 16822/55. Ten/15016.)*

Middlesex.—9th September. County Council. Supply of electric lamps for the period 1st November to 31st May, 1956. (See this issue.)

Midlothian.—23rd September. County Council. Street lighting equipment. (See this issue.)

Moira (Co. Down).—5th September. Northern Ireland Tuberculosis Authority. Electrical installation in Waringfield Hospital, near Moira. J. McCandless, consulting engineer, 6, Murray Street, Belfast.

New Windsor.—23rd September. Borough Council. Electrical installations in 16 flats at St. Andrew's Cottages, Dedworth Road. Borough engineer, Kipling Buildings, Alma Road.

New Zealand.—9th September. General Post Office, Wellington. Instrument cords. (E.S.B. 16731/55. Ten/15025.)*

10th October. Stores Division, Post and Telegraph Department, Wellington. Lampholders, lenses and switches. (E.S.B. 16996/55. Ten/15057.)*

Portuguese East Africa.—20th September. Ports, Railways and Transport Department, Lourenço Marques. One 250 kW and one 125 kW generator. (E.S.B. 16580/55. Ten/15049.)*

Portuguese Guinea.—5th September. Overseas Commercial Delegation. Radio electrical equipment. (E.S.B. 17051/55. Ten/15052.)*

Prestwick.—Burgh Council. Street lighting equipment. (See this issue.)

South Africa.—1st September. Union Tender and Supplies Board. Radio equipment and telephone small parts. (E.S.B. 16848-9/55. Ten/15032-3.)*

2nd September. City of Durban Corporation. 30 single-phase transformers and three 500 MVA, 33,000 V oil circuit-breakers. (E.S.B. 17235-6/55. Ten/15069 and 15072.)* 16th September. 33 kV solid and 33 kV oil-filled underground cables. (E.S.B. 17233-4/55. Ten/15073-4.)*

2nd September. Stores Department, South African Railways. Electrical distribution wire. (E.S.B. 17534/55. Ten/15157.)* 20 starting resistances. (E.S.B. 16573/55. Ten/15067.)* 9th September. 2,600 suspension insulators. (E.S.B. 16916/55. Ten/15028.)*

United States.—30th August. U.S. Department of the Interior, Bonneville Power Administration. 11 power circuit-breakers. (E.S.B. 16895/55. Ten/15093.)*

Uruguay.—23rd September. Administracion General de las Usinas Electricas y los Telefonos del Estado, Montevideo. Black coloured conductors with outdoor insulation. (E.S.B. 16755/55. Ten/15018.)* 27th September. Storage battery sets. (E.S.B. 16756/55. Ten/15061.)* 29th September. 25,000 dry batteries. (E.S.B. 16757/55. Ten/15065.)*

ORDERS PLACED

Bromley.—Corporation. Recommended. Erection and wiring of lamps for the 1955-56 street lighting improvement programme (£5,808).—Erecon, Ltd.

Glasgow.—Corporation Municipal Transport Committee. Supply of cable, etc., in connection with the Rutherglen trolleybus extension scheme (£11,223).—Scottish Cables; (£292).—Hackbridge Cable Co.

Middlesbrough. — Corporation. Recommended. Lighting of the east-west cross-town main traffic route (£4,932); and Acklam Road (£1,530).—North Eastern Electricity Board.

Southampton. — Corporation. Recommended. Renewal of electrical installations at Ludlow Junior Boys' and Girls' Schools (£1,985).—F. H. Wheeler (Southern), Ltd.

Woolwich.—Borough Council. Recommended. Electrical installation at the library site, Sir William Barefoot Drive (Stage 1), Coldharbour estate (£2,035). — Duncan Watson.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barnet.—Major extensions at Queen Elizabeth's Grammar School for Boys (£69,597); county architect, County Hall, Hertford.

Basingstoke.—Flats (42), in King's Road, for T.C.; borough architect, Municipal Buildings.

Bicester.—Council offices for R.D.C.; Architect's Department, Waverley House.

Bishop Auckland.—Shops (6), flats (3), and houses (130); J. Ford, U.D.C. surveyor.

Bourn.—Infant and junior school (£45,000); county architect, Shire Hall, Castle Hill, Cambridge.

Brighton.—Houses (68), on Sections 13, 16 and 17, North Woodingdean; D. J. Howe, borough surveyor, King's Road.

Bristol.—Rebuilding Freemasons' Hall, Park Street; Kenneth Nealon, architect, 28, Orchard Street.

Bromley.—Library in Chatterton Road; F. H. Wood, surveyor to T.C., 19, Charing Cross Road, London, W.C.2.

Carlisle.—Houses (150); city engineer, 18, Fisher Street.

Cinema, Pennine Way; John Laing and Sons, builders, Dalston Road.

Factory for Metal Box Co., Ltd.; Cooke and Partners, architects, Harborne Road, Birmingham.

Chelmsford.—Council chamber and municipal offices on site at rear of public library; V. J. Willis, borough surveyor, Municipal Buildings, Duke Street.

Chester.—Second instalment of College of Further Education for E.C.; Thos. Warrington & Sons, Ltd., 84, Station Road, Ellesmere Port.

Chesterfield.—Works extensions; Coalite & Chemical Products, Ltd., Bolsover.

Clewer (Windsor).—Hostel for 50 aged people, for Berkshire C.C.; county architect, Wilton House, Parkside Road, Reading.

Cumberland.—Additions to schools, Cleator Moor, Thursby and Silloth; county architect, Portland Square, Carlisle.

Darlington.—Houses (114), Branksome estate and (40), Springfield North estate; E. A. Tornbohm, borough architect.

Fifty-bed villa at Aycliffe Hospital for Newcastle Hospital Board, Benfield Road, Newcastle-on-Tyne; chief architect.

Durham.—Technical college at Easington and branch library at Peterlee for the C.C.; Cordingley and McIntyre, architects, The College.

Grammar/technical school at Washington for the C.C.; county architect, Court Lane.

Easington.—Houses (50), at Easington and Horden; R. H. Lumsden, R.D.C. surveyor.

Exeter.—Arts building for the University College of the South West; Sir Wm. Holford & Partners, architects, 2a, Angel Court, London, E.C.2.

Felling (Co. Durham).—Methodist Church, Ellen Wilkinson estate; Fennell and Co., architects, Bridge End Chambers, Chester-le-Street.

Gateshead.—Additions to Gateshead Talmudical College, Bewick Road; Arthur and Kirkup, architects, 13, Swinburne Street.

Guildford.—Public hall at High Street/London Road site (£160,000), for T.C.; Bridgwater & Shepheard, architects to Council, 42, Bruton Place, London, W.1.

Hebburn.—Houses (120) (£54,302); H. C. Bestow, U.D.C. surveyor.

R.C. technical school; county architect, Durham.

Holland.—Residential homes at Holbeach and Spalding for C.C. (£80,000); county architect, Boston.

Houghton-le-Spring.—Factory additions for N. Hyer, Ltd.; Holford and Shenning, architects, 80, Bedford Street South, Liverpool, 7.

Jarrow.—Factory additions for Abbott Laboratories, Ltd.; R. Jordan, builder, North Shields.

Three-, four-, five- and six-storey blocks of flats; borough engineer.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Kirkby.—St. Joseph's Junior School; L. A. G. Prichard & Sons, architects, 14, Dale Street, Liverpool.

Leamington Spa.—Works, Queensway trading estate; H. W. Wilson-Wood, architect, 57, The Parade.

Liverpool.—Ten multi-storey blocks of flats at Kirkby estate and seven blocks at Lee Park; Dr. R. Bradbury, city engineer, Blackburn Chambers, Dale Street.

Loddon.—Council offices (four-storey building), in Drury Lane; R.D.C. clerk, Council Offices, Loddon, near Norwich.

London.—222 flats and eight shops, Lillie Road, Fulham; borough engineer.

Ten-storey office block, Wigmore Street, Mayfair; Higgs & Hill, Ltd., builders, Crown Works, South Lambeth Road, S.W.8.

Offices, Stratton Street, Westminster; Griggs & Son, Ltd., 56, Victoria Street, S.W.1.

Rebuilding and extensions to bank premises at 238/240, Lavender Hill, Battersea; Midland Bank, Ltd., Head Office, Poultry, E.C.2.

Mitcham.—Extensions to central library, for T.C.; H. A. Sandford, consulting electrical engineer, 2, Gate Street, Holborn, London, W.C.2.

Monmouth.—Factory, Hadnock Road; H. J. Williams & Sons, Ltd., Kelvedon Street, Newport, Mon.

Newcastle-on-Tyne.—Houses (222) and flats (49), on the Kenton North estate and police houses (29), on various sites; home for infirm people on the Montague estate (£68,000); city architect, 18, Cloth Market.

Radiological wing at Newcastle General Hospital for Newcastle Hospital Board (£27,500); R. Bowey and Son, builders, Great North Road.

North Riding.—School for subnormal children at Redcar (£37,510); county school architect, County Hall, Northallerton.

North Shields.—Factory, Bird Street, for T. B. Bilton and Sons, engineers, etc.; William Stockdale, architect, 73, Howard Street.

Northumberland.—New schools for the E.C. at Alnwick (architects, Reavell and Cahill, Lloyds Bank Chambers, Alnwick); Morpeth (P. L. Browne, Son and Harding, Pearl Buildings, Newcastle-on-Tyne); and Wallsend (Gray and Partner, Camden Street, North Shields).

Peterborough.—Houses (60), in three groups on the Dogsthorpe North estate; L. H. Robjohn, city surveyor, Town Hall.

Richmond (Surrey).—Houses (100), at Peldon Avenue, for T.C.; Major W. V. Zinn, consulting engineer, 172, Buckingham Palace Road, London, S.W.1.

Shops with offices over, adjoining the Town Hall; borough engineer.

Runcorn.—12 houses at Halton, 34 at Frodsham, and further 36 at Cobbs Quarry, Appleton; R.D.C. surveyor.

Scunthorpe.—Riddings Secondary Modern School; Clarke, Hall & Scorer, architects, 200, High Street, Lincoln.

Sheffield.—Chaucer Secondary Modern School, for E.C.; Ackroyd & Abbott, Ltd., Willoughby Street.

Southall.—Four blocks of flats on sites at the Broadway, Uxbridge Road, etc., and 304 dwellings on the Golf Links estate, for B.C.; J. R. Syrett, town clerk, South Road, Southall, Middlesex.

Stanley (Co. Durham).—Houses (62), on the Durham Road housing site; J. R. Heslop, surveyor.

Stockton-on-Tees.—Houses (42), adjoining Albany Road estate; borough architect, 28, The Square.

Houses (242), west of Fairfield Road; borough architect, 28, The Square.

Stoke-on-Trent.—Factory on the Newstead industrial estate; Thomas C. Wild and Sons, china manufacturers, St. Mary's Works, Longton.

Stony Stratford.—Fire station in Wolverton Road (£10,800); county architect, Buckingham.

Sutton and Cheam.—Council suite, administrative offices, public hall, etc., for Civic Centre scheme, for T.C.; Milner & Craze, architects, Crawford Street, London, W.1.

Swindon.—Additional factory building at the industrial estate; borough architect.

Wallasey.—Out-patients', casualty, pathological and physiotherapy departments at the Victoria Central Hospital, for the Liverpool Regional Hospital Board; regional engineer, Union Street, Liverpool, 3.

Wellington (Salop).—Old people's home at the Vineyard (£49,100); C. H. Simmonds, county architect, Column House, London Road, Shrewsbury.

West Hartlepool.—Houses and bungalows (205), on west of Stockton Road for the Eldon estate; T. H. Turnbull, architect, 6, Scarborough Street.

Wolverton.—First stage of grammar-technical bilateral school; county architect, Buckingham.

Yorks (East Riding).—County hall at St. Mary's Manor; county architect, County Hall, Beverley.

Last Year's Canadian Electrical Exports

Recession Continued

Canadian exports of electrical goods last year, which were valued at approximately $23 million, showed a decline of about $15 million on the previous year. The downward trend has been apparent also this year. The most notable recession was in communication equipment; notably miscellaneous radio apparatus, but not receiving sets. On the other hand power plant exports increased as also did insulated cable and wire. At the same time there was continued evidence of the efforts of Canadian electrical manufacturers to find new markets. The accompanying table shows the values of the chief groups, with notes of increases or decreases on 1953, and a few of the leading destinations.

Class of Goods	1954 $ (000)	Inc. or dec. on 1953 $ (000)
Storage batteries	230	− 138
To Ceylon	8	+ 2
,, Colombia	126	− 73
,, Ecuador	8	− 1
,, Egypt	16	+ 13
,, Israel	9	− 1
,, Venezuela	15	− 39
Storage battery parts	84	+ 51
To Venezuela	19	− 1
,, Brazil	13	+ 13
,, U.S.A.	25	+ 24
Batteries n.o.p. and parts	190	+ 151
To U.K.	15	+ 15
,, Denmark	75	+ 75
,, France	17	+ 17
,, Netherlands	26	+ 26
,, Italy	20	+ 20
Radio receiving sets	1,516	+ 522
To Australia	434	+ 434
,, Colombia	22	− 74
,, Chile	24	+ 22
,, Cuba	27	− 10
,, Iran	12	+ 3
,, Peru	20	− 15
,, Uruguay	16	+ 16
,, Venezuela	70	− 261
,, U.S.A.	223	− 49
,, Portugal	87	+ 85
Radio apparatus n.o.p.	6,833	− 16,094
To Australia	94	+ 76
,, Denmark	121	− 656
,, India	139	− 398
,, Italy	491	− 480
,, Netherlands	139	− 840
,, Indonesia	60	+ 37
,, Portugal	132	+ 103
,, U.S.A.	5,288	− 6,627
Telegraph and telephone apparatus	1,787	− 600
To Brazil	65	− 36
,, Venezuela	18	−
,, Greenland	49	+ 49
Transformers and parts	1,194	+ 476
To Brazil	671	+ 101
,, El Salvador	43	+ 41
,, Venezuela	293	+ 234
,, U.S.A.	137	+ 105
Dynamos, generators and parts	2,369	+ 691
To India	19	+ 19
,, Brazil	2,172	+ 1,044
,, U.S.A.	115	− 210
Meters and parts	1,370	− 108
To Mexico	267	+ 131
,, Brazil	627	—
,, Colombia	52	− 6
,, Guatemala	27	− 45
Motors and parts	1,125	+ 123
To Australia	67	—
,, New Zealand	88	+ 34
,, Mexico	133	+ 79
,, Colombia	46	+ 39
,, Venezuela	60	− 8
,, U.S.A.	625	+ 186
Spark plugs	2,032	+ 434
To South Africa	466	+ 133
To India	336	+ 104
,, Belgium	167	+ 15
,, Cuba	100	+ 19
,, Venezuela	210	+ 43
,, Netherlands	110	+ 110
Switches and wiring devices	123	− 2
To Trinidad	8	− 12
,, Venezuela	11	+ 8
,, Jamaica	7	− 9
,, Brazil	10	+ 8
Electrical apparatus n.o.p.	3,744	− 329
Refrigerators (power) and parts	287	− 175
To Panama	13	− 22
,, Venezuela	37	− 38
,, U.S.A.	106	+ 77
,, Jamaica	14	+ 8
,, Trinidad	30	+ 16
Vacuum cleaners	7	+ 1
To U.S.A.	4	+ 1
Domestic washing machines	530	− 96
To Australia	50	+ 50
,, Belgium	28	+ 18
,, Brazil	29	+ 13
,, Colombia	27	+ 2
,, Peru	70	− 29
,, Switzerland	70	− 31
,, South Africa	25	− 35
,, Venezuela	64	− 26
Cooking stoves	91	+ 7
To U.K.	50	+ 28
,, Trinidad	8	+ 7
,, Bermuda	17	+ 2
Cooking and heating devices	253	+ 212
To Colombia	5	+ 4
,, Peru	6	+ 6
,, Mexico	4	− 2
,, U.S.A.	216	+ 204
Insulated copper wire	5,133	+ 977
To Colombia	375	+ 97
,, Dominican Republic	92	− 55
,, Philippines	317	− 44
,, Venezuela	181	− 487
,, U.S.A.	3,531	+ 2,260
,, India	91	+ 91
,, Greenland	143	+ 143

Abolition of Electricity Tax Urged

The Federation of Swedish Industries has asked the Committee on Indirect Taxation to recommend the Government to abolish the electricity tax as soon as possible. The Federation says that production costs in Sweden have gone up considerably during the last few months and exceed those of other countries competing with Sweden in export markets.